The Farmer's Digest

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Breeding Horses to Remount the Army

Condensed from The American Hereford Journal

Major R. M. Graham

Quartermaster Corps, Headquarters North Central Remount Area

EXPERIENCE during the World War taught our army that many so-called riding horses presented for sale were far from the type required for military purposes. With this very practical and severe lesson, the horsemen of the Army knew something must be done in order to improve the breeding of horses —so that more stamina and better conformation could be bred into them, thereby making them more suitable for the continued hard use—so necessary for the Army.

From this was born the organization known as "The United States Army Remount Service" —in the year 1920. That makes this service but 20 years old, and, when compared with the remount services of foreign countries, it makes us very young indeed. For example, the remount services of both France and Hungary were formed about 200 years ago. Our service was started with approximately 150 stallions. Today, we have 665 stallions of the following breeds: 14 Arabian, 18 Morgan, 3 Saddle-Bred, 1 East Prussian and 630 Thoroughbred.

The reason for the predominance of Thoroughbreds is that this breed is most easily procured, and has been found universally suitable to produce the Army-type horse. In the United States there are only 319 Arabian stallions, and their price to us is too high for the purchase of many. The Morgan is a good breed, but only approximately 180 of both sexes are registered annually. The American Saddle Horse is a good breed, but, because of its gaits, is unsuitable for military use. All of our horses must be straight walk, trot and gallop horses.

We try to select our stallions carefully; none must have transmissible defects, and they should

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possess calm dispositions. We try to use stallions that will beget horses we will purchase in war or peace. These stallions are placed with civilian agents in various states, who apply to their Remount Area Headquarters for stallions, whereupon, they are furnished the conditions under which stallions are assigned, together with a questionnaire.

After returning the questionnaire, giving information called for, they are, within a reasonable length of time, visited by a Remount officer who inspects the facilities for care of a stallion and, also, the type of broodmares in the community: If approved, and stallions are available, they are shipped at Government expense to the agents, who are allowed to charge not to exceed $10 per mare service. Fees collected belong to the agents, who are expected to use the money for feed and care of the stallions.

Remount headquarters are as follows:

Eastern Remount Area: Headquarters—Front Royal, Va. (States of Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Vermont and Virginia).

East Central Remount Area: Headquarters—434 P. O. Bldg., Lexington, Ky. (States of Alabama, Florida, Georgia, Illinois, Indiana, Louisiana, Michigan, Mississippi, North Carolina, Ohio, South Carolina, Tennessee, West Virginia, Wisconsin, and Puerto Rico).

North Central Remount Area: Headquarters—502 General P. O. Bldg., Kansas City, Mo. (States of Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska—excluding counties of Banner, Box Butte, Cheyenne, Dawes, Deuel, Garden, Kimball, Morrill, Scotts Bluff, Sheridan and Sioux—North Dakota and South Dakota).

South Central Remount Area: Headquarters—3301 El Campo St., Fort Worth, Tex. (States of Oklahoma and Texas).

Northwestern Remount Area: Headquarters — Fort Douglas, Utah. (States of Idaho, Montana, Utah and Wyoming).

Southwestern Remount Area: Headquarters—Colorado Springs, Colo. (States of Arizona, Colorado, and New Mexico).

Western Remount Area: Headquarters— Avansino Bldg., 72 Third Ave., San Mateo, Calif. (States of California, Nevada, Oregon, and Washington, Territory of Hawaii).

Robinson QM Depot Remount Area: Robinson QM Depot (Remount), Fort Robinson, Neb. (Following counties of Nebraska: Banner, Box Butte, Cheyenne, Dawes, Deuel, Garden, Kimball, Morrill, Scotts Bluff, Sheridan and Sioux).

In addition our Remount Ser-

vice has three Remount depots, as follows:

Front Royal QM Depot: Front Royal, Va.

Reno QM Depot: Fort Reno, Okla.

Robinson QM Depot: Fort Robinson, Neb.

At these Remount depots, we breed some of our stallions, and receive all horses and mules purchased. Our mounted regiments get their animals from these depots.

Mare owners, who breed to our stallions, are not obligated to sell the resulting horses to the Army. Such purchases are made by the Army from time to time, depending on its requirements and on appropriations by the Congress.

There are at present about 20,000 horses and mules used by our Regular Army. In addition, our National Guard and ROTC use several thousand horses. These horses are all of the riding, or light draft type. It is not necessary for the draft animal of the Army to be able to do the heavy draft work he formerly was required to do. This is largely due to the fact that he is almost entirely used in the Field Artillery, where the guns and vehicles have rubber tires and Timken roller bearings, and, therefore, move much more easily than the former types.

In addition to this, the artillery horse of today must be able to keep up with the cavalry. This calls, you might say, for the oversized riding-type of horse, that weighs between 1,100 and 1,300 pounds, and must be as free-moving as any riding horse.

All of these horses are purchased by our Remount Service, preferably, from breeders. However, at present, it must be said that many animals presented to us by breeders are not up to our specifications because of unsoundnesses, lack of quality, way of traveling and predisposition to unsoundness, such as crooked hind legs, cow-hocks, splay-feet, pigeon-toes, ewe-necks, mutton-withers, small, round barrels, long backs, straight shoulders, calf-knees and flat feet.

It is safe to say that these unsoundnesses—lack of quality, way of going and general faults of conformation—are, generally, directly traceable to the mares. Most of the original mares had much draft blood in them, and had weaknesses not desirable from a riding standpoint, such as short necks, heavy heads, calf-knees, flat feet and crooked hind legs. If possible, they should not be bred to our stallions, for the chances are, breeders will be disappointed when they come to sell to us. Mares should be of the same type as the stallion. If drafty mares must be used, then only their best fillies should be kept as broodmares.

For horse breeders to sell

horses to the Army or any experienced purchaser of horses, the culling of broodmares should be practiced. It costs no more to raise a good horse than a poor one.

Horse breeders should not depend upon the Army as the only consumer of their horses, but should be able to use some of them and sell some of them to civilian buyers. When we need them, we will be glad to inspect with a view to purchase, but our standard is high. None but the soundest and most robust horses will withstand marching day after day and, perhaps, night after night, under heavy loads. Horses that are perfectly good for cattle work may not be all right for use on hard roads or gravel shoulders. For example, wire cuts through the coronary band, causing a quarter-crack or side-bones, may never cause lameness on soft ground, but on hard surfaces might mean a lame horse very shortly, on a march.

We are sure that, in time, breeders will use better broodmares, feed them and their colts better and keep their colts out of wire. In this way only can they produce top horses, and, therefore, sell them more readily, not only to the Army, but to civilians who often pay high prices for top horses.

Flaming Peach

Almost everywhere peaches are grown in this country and Canada, eyes are on the new Elberta variety. It is called Redelberta, thus emphasizing one of the two characteristics which distinguish it and which give it wide advantage over its parent. A bud sport of the common Elberta, this new peach ripens 10 days earlier and carries more color, the latter being its chief claim for attention. Redelberta trees have gone for trial and observation to most of the U. S. areas that grow peaches. *—W. J. H., Minn., in Successful Farming*

A Mastitis Control Program

Condensed from Guernsey Breeders' Journal

Floyd S. Barlow

NO longer need the dairymen of America accept the disease of mastitis as a necessary or unavoidable millstone on the neck of the industry as it has been for more than fifty years. It was just about that far back when Pasteur of France and Lister of England were discovering that diseases were caused by micro-organisms. At that time the writer's father was milking over 100 cows and lost sixty-four quarters in one year, the bacteria being carried from cow to cow by wet-hand milkers. Dr. James B. Law, Dean of Cornell Veterinary College, went to the farm but could give no clue as to the cause or any suggestions for relief.

Many research men in this country and abroad have worked contemporaneously on this disease that has been variously estimated to take an annual toll in this country alone of above $70,000,000. It remained, however, for Dr. C. S. Bryan, of the Michigan State College, of Agriculture, to give the industry a working program for control, yes, for complete eradication from any given herd.

Dr. Bryan has given the better part of his life to this subject as a research worker, and for more than ten years has worked tirelessly on the problem. At every step Dr. Bryan kept in mind the practical application by dairymen of the knowledge he acquired. At this writing there are more than thirty herds of cattle in Michigan under Dr. Bryan's supervision that are absolutely free from the disease, including one herd of seventy-five pure bred Guernseys. Many other herd owners are co-operating with him.

The Michigan plan has been brought to Ohio under the direction of Dr. F. L. Carr, Dr. D. C. Hyde and Dr. E. W. Roberts, of the State Department of Agriculture, Dr. A. F. Schalk, of the College of Veterinary Medicine, and Dr. T. S. Sutton, of the College of Agriculture. Five pure bred herds have been accepted by them for demonstration for the first year and milk tests are being made monthly at the state laboratory. It is the thought of these leaders that working together with the Ohio Livestock Disease Control Association, a plan of administration and financing will be developed that will eventually make it possible for any dairyman of the state to have his herd under test.

Reprinted from the Guernsey Breeders' Journal, May 1, 1940, Peterborough, N. H.

It is our opinion that every state dairymen's association and every dairy breed association in the Union should, during the next few years, make the task of mastitis control their principal concern. By common consent, the biggest and most vital problem of the dairymen is a lower cost of milk production so that milk will compete successfully with other food products and thereby gain increased consumption. How often we have heard it said, "Mastitis has cost the dairymen of this country far more than either Tuberculosis or Bang's Disease." Just think of a national cut in cost of milk production of $70,000,000 annually. Pure bred dairy cattle owners must be the pioneers in this work. They must be the first to adopt the program, and they must develop the necessary machinery to make it available for the industry.

During the early years of his investigational work, Dr. Bryan came to the conclusion that "approximately eighty-six per cent of all dairy herds and twenty-six per cent of all dairy cows are infected with streptococcic mastitis; that milk and butter fat yields are reduced twenty-five per cent, and the quality of the milk by fifty per cent; that the bromthymol test will find only approximately fifty per cent of the infected cows; that to date no effective cure or a preventative vaccine has been discovered; that the only method by which all the disease in a herd may be discovered is the microscopic test of the milk; and that the only solution is complete isolation and final elimination of diseased animals from the herd."

Dr. Bryan's program is a purely voluntary one, the success of which depends upon the wholehearted co-operation and eternal vigilance of cattle owners. He believes it inadvisable that the work be set-up in any state without the co-operation and employment of veterinarians to collect the milk samples. There are types of the streptococcic bacteria everywhere. The possibility of contaminating milk with these other bacteria that may interfere with complete detection of the mastitis "strep," is too great for laymen to attempt to collect samples.

Dr. Bryan has developed a practice for preserving samples that makes it possible to ship them from coast to coast and accurate results are obtained when samples are tested. He has developed a technic of testing that is very practical and efficient. In our judgment, the wise reader of this article will do exactly what was done in Ohio, and that is to bring Dr. Bryan to your state. His college will allow him to come if you pay his expenses, and you start in where Michigan is now after ten years of work. He will give your state every-

thing he has, lock, stock and barrel, because he did it for us. After going to Ohio and witnessing the intense interest and the initial set-up he said, "I have never experienced such lack of prejudice and such whole-hearted acceptance of a program. Because of it I predict that within five years Ohio will be ahead of Michigan. Your leaders will benefit by our groping and our mistakes."

The following are the steps in the program as Dr. Bryan and Dr. Giltner, chief of his department, believe that mastitis control may best be set up in any state.

1. The work of milk testing should be done at a central laboratory by trained technicians, preferably in co-operation with the state. The central laboratory should prepare the vials for sample collecting. The testing consists of incubating the samples for twelve to fifteen hours, after which smears are examined under a high-power microscope.

2. Competent veterinarians should be employed to collect the samples,—men who have been given detailed instruction by laboratory officials. Tests are made each thirty days until such time as infected cows are removed from the herd and each three to six months thereafter. The test is to be applied to the milk of lactating cows only because the serum obtained from dry cows is not suitable for test.

3. Cows that are badly infected should be sold for slaughter. They should not, under any circumstances, be sold to a dealer, first, because it is unlawful to sell a cow known to be diseased unless the facts are told, and again because it would be highly unethical. Cows may be sold for breeding purposes to another breeder when, and only when, the facts are known by the purchaser.

4. All infected cows will ultimately have to be sold from the herd. Until such time as it is feasible to remove them, they should be segregated at the end of the line and always milked last. They should not be milked with the milking machine.

5. The milk from infected cows not in the advanced stages of the disease may be marketed, provided it is pasteurized. Such milk should be found to be normal by physical examination or the bromthymol test. The milk from some other cows that the veterinarian has not recommended for immediate slaughter may be fed to calves that are to be slaughtered. Such calves must at all times be segregated with the infected cows.

6. Lime (hydrated or ground limestone) or superphosphate should be used in profusion on walks, gutters and platforms of the entire stable. Such walks, gutters and platforms should be

cleaned and flushed at frequent intervals and disinfected with chlorine solution 200 parts per million.

7. Before milking, the udder of each cow should be wiped with a clean cloth moistened with chlorine solution fifty to 100 parts per million. A different cloth should be used for infected cows. All utensils used should be thoroughly sterilized after infected cows are milked. It must be understood that infected cows are a menace as long as they remain in the herd, consequently these and additional instructions as given by your veterinarian should be followed.

8. The proper drying off of cows is an important step in this program. Each co-operator should consult his veterinarian when necessary.

9. Replacements may be made by raising heifer calves or by buying healthy cows that have been given the microscopic test and found free from the disease.

It is the belief of both Dr. Giltner and Dr. Bryan that mastitis is a disease that will not lend itself to a system of indemnities as in the case of tuberculosis and Bang's Disease; that the only dairymen who will have clean herds will be those who enter the work with a thorough knowledge of what must be done and a determination to do it.

As we view the matter, the co-operating dairyman has everything to gain and nothing to lose except that he cannot sell animals found to be infected. He can, however, keep them as long as they are profitable producers and as breeders as long as he desires. One co-operator in Michigan keeps his last two infected cows in a horse barn and the calves milk them. He is doing this in order to get their calves to carry on his breeding program.

Then, too, as one of the Ohio co-operating breeders remarked, "Now that we know how to free our herds from mastitis, we had better get it done while we can do it with the least financial loss and before our city health departments give us a dead line and force us to do it." Think of the satisfaction of being able to sell a cow to another breeder knowing she is absolutely free from mastitis as well as tuberculosis and Bang's! The saving of just one good breeding matron should pay the costs for the lifetime of an owner. As in the case of Bang's Disease, tests should continue always after the herd is known to be clean and should be made at least as frequently as every six months.

Who Buys Farms?

Condensed from Free America

Elliott Taylor

THIS is a matter of fact report on a realistic subject which for a long time has revolved in the stratosphere of sentiment, theory, and pseudo-philosophy. It is designed to be read by those who are interested in leaving the cities and establishing themselves in the country.

The movement back to the land has not in any sense reached the proportions of a major migration. That it may continue to accumulate momentum and mass comes within the range of possibility and veers toward probability. At present the sentiment for the land is strong in the minds of many Americans who are thoroughly disillusioned in their view of the centralized, urbanized, industrial civilization that has let them down. They have waited, many of them, nearly a lifetime for the pay-off that never came. Our inquiry is concerned with those who, through prudence or good fortune, or both, have retained a measure of control of their own destinies, and who are now looking landward for the security and satisfaction that the cities have denied them. For a composite picture of this class, as seen through the eyes of practical men who are dealing with farm seekers every day in the year, we can turn to no better source than the real estate brokers who specialize in country property.

It must be said at the outset that the condemnation that many urban real estate speculators have brought down on their craft cannot be applied in blanket indictment against the farm property specialists. The typical farm broker is, often as not, more farmer than he is broker. In many instances he is himself engaged in farming operations, his real estate activities carried on as a side line for that necessary cash crop without which subsistence farming cannot succeed. His position is seldom as simple as that of an agent bringing together buyer and seller. His activities often range from agricultural advisor for newcomers who badly need advice, to that of social mentor of those who have yet to learn that city standards and conduct must be readjusted before they can stand the test of rural keenness.

These were the brokers that were queried in a recent national survey conducted on the trend in

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country real estate. Replies received embraced twenty-six states, and represented the studied opinions of brokers who have farm listings totaling over twenty thousand separate properties. They have described, shown and sometimes sold farms to over fifty thousand individual buyers or prospective buyers. Each report represents the individual experience of a single dealer as far as his own limited sphere of operations is concerned. Yet these operations vary widely from middle and far western offices, dealing in enormous acreages, to eastern agencies operating within commuting distance of many big metropolitan centers, and specializing in small farms of as little as two or three acres each.

Our first attempt was to discover *who is thinking of buying a farm,* as evidenced by inquiries to the various farm selling agencies. Sixty-five percent of all such inquiries reported were from city dwellers interested in moving into the country. All who come to look do not remain to till the soil, it is true. Another twelve percent constituted city buyers who indicated that they were interested in buying country land as a secure form of investment and a hedge against the vagaries of an uncertain future. Only twenty-four percent came from practical farmers and non-city residents. It is interesting to note in this connection that, whereas the sellers whose prospects were mainly practical farmers could report on the average no increase in inquiries for 1939 as compared with 1938, seventy percent of those who had a majority of their dealing with city buyers did report an increase in prospects for last year as compared to the year before. And of all the brokers who answered the specific question, eighty-one percent said that over half of their transactions had been with former urban residents who bought farms.

The biggest demand is for small farms, and farms that can be bought at a low price, both in respect to down payment and total cost. These requirements present a difficult problem since most all of the brokers find such farms at a premium. The most common listing in a majority of cases was eighty acres or more. Prices of land varied widely, going over the two thousand dollar an acre mark in some communities, and ranging down to almost nothing in others.

One broker reported "you can buy land for nothing in this locality if you will just pay for the improvements that are on it." The average range of prices for good plow land without improvements was from $47 to $109 per acre. Farm prices for the whole country would appear to have remained about the same for the

past year, with perhaps a slight increase. Here again the type of buyers who are interested in this type of property show an effect on the market price of all listings. The price bracket into which the greatest number of reported 1939 sales fell was $2,000 per farm and under, while seventy-six percent of the selling agents claimed that most of their sales had been in properties costing under $5,000.

And yet, even at these low prices, most of the farms could not have been abandoned or non-productive acreage. Seventy-one percent of all farms listed for sale were reported as being under cultivation. Eighty percent had liveable houses. Sixty-seven percent had good barns. Fifty-six percent had electricity in or available, and about one-third were offered with some livestock, tools and equipment included in the price.

In response to a specific question regarding the age group into which buyers fell, forty-six percent were found to have been "middle-aged couples with children to help them farm"; twenty-eight percent were "elderly folk who want to do light farming for their own consumption," and only twenty-six percent "young couples just starting out."

Twenty-five percent of the purchase price was the most common down payment, and seventy-six percent of all brokers reporting said that down payments on purchases were one third cash or less. The accusation has often been made that the broker is interested only in the down payment out of which his commission is extracted; but it must be said to the credit of the farm brokers that seventy percent stated that they do not encourage prospects to attempt to pay for a farm out of its earnings. And most of the thirty percent who make exceptions to this rule said that only to practical farmers, who give every indication of knowledge and ability to farm, do they give such encouragement. The majority of farm buyers, then, appears to be recruited from the army of disillusioned and dispossessed that is silently leaving the cities, seeking inspiration and security on the land. They recognize that the practical aspects of their problem can be met only with practical solutions.

Already the farmward trend is beginning to set a pattern based on individual initiative and democratic decision. The ultimate outcome of it all is still in the realm of speculation. Practical and useful data are rare, and will become available only as those who are again undertaking to captain their own destinies are able to reconcile the essence of things hoped for with the substance of the things found.

But from the hundreds of case histories represented by the reports that farm brokers have

made, some sage counsel is worthy of note. Many sally forth to investigate the land, guided only by blinding visions of the impossible. Thus a broker writes: "Advise prospective buyers not to read into farm advertisements qualities that are not there . . . don't expect a twenty-five acre, $800 farm to be located on a U. S. paved highway, close to town, with electricity, modern conveniences and buildings in the best of repair, unless the description includes these features."

"Another mistake," observes a correspondent, "is the idea of many prospects that they should get possession of a forty to one hundred acre farm, stocked and equipped for a down payment of $500. This is only throwing $500 away, even if the owners would part with their property on such terms."

Pondering the question of success and failure in farming undertakings, a New Englander says, "Sometimes a buyer seems to have everything in his favor, but fails because of lack of industry or judgment. In other cases, a buyer seems to have nothing in his favor, but industry and good judgment pull him through. Who can weigh these intangible and invisible qualities?"

Industry and good judgment, fundamental qualities that have become outmoded in the cities' industrial scheme which extols assembly-line precision and unquestioning conformity in their stead—these again may become agencies of a new security, in the wake of the movement onto the land.

Nearly two-thirds of all the lamb eaten in the United States is consumed north of Washington and east of Pittsburgh, an area which grows less than five per cent of the country's sheep.

Fail-Proof Hay

Condensed from Farm Journal and Farmer's Wife

IN spite of all it can do, tradition is about to lose its hold on a farm job it has held securely for a long time. Haymaking is the job I mean; and that conclusion is based on what I am about to relate.

In March, Carl Oberlin, in Richland county, Ohio, showed me some mixed clover and timothy hay (made last June) which had never been cocked, stacked nor stored in a haymow. The hay was slightly brown, but it had all its leaves, and an aroma that made the cows go for it. Testing association Holsteins ate 40 pounds per head of this hay (along with farm grains) daily last winter. On twice-a-day milking they gave more milk than the high association herd milked three times daily.

This hay, which the cows ate so greedily and profitably, had been run through a hay chopper and blown into a circular metal building about 16 feet in diameter with perforated outside walls, a three-foot ventilating flue in the center and a rotating weather-proof ventilator on top. When the hay was blown in, it was so wet you could squeeze water out of it.

Another story of satisfaction with hay chopped and blown into an all metal ventilated storage came to me first hand from C. B. Caudill, Shelby county, Kentucky. For four years he has filled his 25 x 45-foot circular building with alfalfa hay. It holds about one hundred tons. He cuts alfalfa in the morning as soon as the dew is off, turns it into windrows with side delivery rake, hauls and chops it in the afternoon.

The hay Mr. Caudill was feeding out of this metal building in April had plenty of leaves and as good color as you could get from stack or mow. His answer was "No, sir," when I asked him if he would rather put his alfalfa into a haymow. He has never had any spoiled hay. His 56 Guernseys clean up all the hay each year.

First cost of this type of hay storage is about $25 a ton of cured hay. Starting from scratch a farmer can build a dairy barn without a haymow and put up one of the metal hay storage buildings for about the same cost as a two-story dairy barn. Putting the hay in the metal building removes practically all the fire risk from the dairy barn.

"Barn-cured" is a term applied to hay cured by a new method developed and tested jointly by

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the University of Tennessee and the TVA. This method, think the engineers who fathered the idea, is the way to get around that greatest of all haying handicaps in the ten southeastern states—an average monthly rainfall of 4.56 inches during the hay-drying season, May through September.

Along with John A. Schaller, TVA's agricultural engineer, I visited Luther Jackson's farm near Maryville, Tennessee, where one of the barn-curing systems was installed to handle last year's alfalfa. That was in April, and there was some of the barn-cured hay left in the mow. It was good hay. Steers stretched their necks and stuck out their tongues for it.

In one end of the barn there was also a little hay that had been put in hastily (to escape a storm) before the barn-curing system was installed. This was matted together in big black chunks, the color of coal.

Enough of the hay had been fed out of the mow to leave the curing installation exposed. It was like this: A tight mow floor of tongue-and-groove lumber had been laid over the old loose one (an airtight mow floor is an essential part of this barn-curing system). Lengthwise down the middle of the mow, resting on the floor, was a wooden flue or duct with its lower side open. Taking off at right angles were smaller flues or ducts—these, too, with their lower sides open. Instead of resting directly on the mow floor, the ducts were raised to leave a one-inch crack along the edges.

After the hay (partially cured in the field) is put into the mow in the usual way with hay loader and hoist, a blower with two air outlets delivering 12,000 cubic feet of air per minute, is connected to the main flue. Thus, air is forced through the ducts and out through the cracks along the edges and up through the hay. As it moves through the hay, it carries moisture away with it. The blower (electrically driven) has automatic control. A humidistat start and stops the motor, depending on the dryness of the air. If a thundershower comes up, the humidistat stops the blower, so it will not blow moist air through the hay.

Complete installation in the Jackson barn (including motor and blower, new floor and ducts) cost close to $500. The mow is 31 x 82 feet, and holds 60 or 70 tons of hay. Last year it took 41 kilowatt hours of electricity per dry ton of hay to do the curing. The system is operated for from ten days to two weeks after the hay is put in. A time switch is used to start and stop the motor for short periods at night for several nights to prevent overheating.

Unlike any of these is the method used by Charles S. Colburn, Bremer county, Iowa, with

alfalfa last June. He cut the crop and let it cure in the field, almost to the point where it could have been put into the haymow. Then he ran it through a hay chopper and blew it into unlined field cribs of slat fencing. He added 80 pounds of corn sugar molasses (a corn-belt product) as it went through the chopper.

Whether this molasses-treated alfalfa should be called hay or silage is another question. More to the point than this technicality are the results Mr. Colburn got in feeding the chopped roughage to 200 sheep and to 60 calves from the sand hills of South Dakota. "The sheep were crazy for it," he says. "Calves ate every bit of it. Chopping is the only way I would ever put up hay. I would rather have this for feeding sheep than anything else I have ever used. Calves did well on the chopped hay and cracked corn."

On Bert Hanson's farm, Blue Earth county, Minnesota, a pick-up baler, used for two seasons, proves to be, according to Mr. Hanson's experience and judgment: "By far the cheapest method of handling market hay.

"Each year we deliver many tons of alfalfa directly to market from the fields. We have had no complaint on quality of hay baled from the windrow. In fact, we have trouble with stack- or barn-baled hay after delivering windrow-baled, because windrow-baled is always leafier on the same grade or quality of hay.

"Our successful method is to leave the hay in small windrows until very dry. We let it lay until evening dews toughen it slightly, so as to prevent leaf loss. Baling from the windrow with us is a matter of a few hours' work baling daily and the time is governed by the atmosphere. We use lights and bale only when conditions are right.

"Alfalfa can be baled in any condition normal for putting in a stack or barn; but, of course, you will take out only the grade you put up, less normal deterioration. We have use for a lot of alfalfa that has no market value, and when we get caught with hay under No. 1 grade we usually feed it. Last year out of over 700 tons delivered less than 3% graded below No. 1.

"We have handled large amounts of alfalfa the past ten years and have definitely gone to windrow baling as the only sensible solution under our conditions to handle a volume. We hope to deliver well over 1,000 tons to market this year. Four men operate the balers we use and bale two and one-half to four tons per hour."

Another place haying tradition is losing ground is among the agronomists who now attach less importance to hay yield per acre and more to hay quality. That is why they are urging farmers to

cut hay crops early so as to get greater feeding value per ton.

Despite all the progress in haying methods, the mower and the side-delivery rake are still basic equipment needs. Whatever the method of storage, nothing has thus far minimized the importance of a good mower with sharp knives, properly adjusted for light draft, nor of the ability of a side-delivery rake to make a windrow with the leaves tucked inside away from the sun.

—*M. G. K.*

New Control for Peach Borers

Condensed from The Ohio Farmer

Ray T. Kelsey

HAILED as being more effective in controlling borers in peach trees than the standard materials now used, as being easier to apply and with less danger of injury to the tree, and above all as being less expensive, a chemical widely used in grain fumigation is now advocated for use by peach growers by Dr. D. M. Daniel, entomologist at the State Experiment Station at Geneva, N. Y.

The new material is an emulsion of a chemical known as ethylene dichloride and potash fish-oil soap diluted with water and applied directly to the tree regardless of age. It can be poured or sprayed about the base of the tree with equally good results, and can be applied at a time when other orchard work is not pressing. The last two weeks of April and the first week of May generally prove best for spring treatment, although the dates vary according to the season.

The new treatment is more effective in cool weather than in hot weather, and can therefore be used early in the season or later in the fall than can the old treatment with a paradichlorobenzene which requires a soil temperature of 60 degrees or above to be effective. Ethylene dichloride emulsion has given excellent control in western New York when applied as late as the middle of November. It appears to be safer on young trees as well as more effective than the so-called "crystal ring" treatment with "P. D. B."

Detailed directions on the preparation and use of ethylene dichloride emulsion for the peach borer may be obtained upon request to the New York Experiment Station, Geneva, N. Y.—*American Agriculturist*

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They Test New Wheats

Condensed from The Farmer

William H. Kircher

EACH year as wheat yield reports come rolling in from the spring wheat belt the millers get jittery, and there is good reason for their jitters. If some new variety outyields all the others, new and old, they can be sure its popularity will spread, regardless of its milling quality. In that case there is trouble ahead for everyone—the farmers, the millers and the bakers. The bakers run into trouble with their bread, the millers get complaints from the bakers, and the next year these complaints are translated for the farmers into terms of lower price for faulty variety.

Chances that varieties of poor milling quality will be introduced by any of the agricultural colleges or by the United States Department of Agriculture are greatly minimized by exhaustive milling tests before the varieties are introduced. However, that is not always the case of varieties coming from other sources. When one of these untested varieties makes a good yield record and then falls down when it goes to the mills, there nearly always is the criticism that "the millers don't want anything new. They just arbitrarily say that this wheat is of poor quality, or that one good, without even giving it a fair trial."

It may appear that there is reason for this criticism but actually there is not. For obvious reasons a miller welcomes any wheat variety or combination of varieties which will make uniformly superior flour. And the miller doesn't allow himself to be fooled about what is good and what is not. Samples of every batch of flour going through the mill must pass a favorable milling and baking test in the mill's own laboratories before any of the batch is sold. These laboratories are staffed with chemists and with bakers who discover, if present, any flaws in absorption, crumb color, loaf volume and other characteristics of the flour. To those outside the flour and baking business, some of these characteristics may seem unimportant, but they are tremendously important to those in the business, and those are the people who buy the wheat.

A few years ago the millers, working through the Northwest Crop Improvement Association, hit upon a co-operative testing plan which broadened the useful-

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ness of their laboratories. Under this plan the Northwest Crop Improvement Association secured samples of certified seed from the colleges, seeded it in small plots throughout the spring wheat belt, threshed this wheat separately, and then sent it to the mills for separate milling. This wheat is run through small mills and then divided among workers in the laboratories of several milling concerns. So much benefit has been derived from this co-operative testing that the practice has grown from year to year. This year the laboratories of 17 mills tested 698 samples of 12 varieties, and following the tests the laboratory bakers and chemists got together, checked results, and on the basis of results, offered recommendations.

Tested Varieties

Varieties tested were Thatcher, Pilot, Rival, Renown, Nordhougen, Vesta, Premier, Mercury, Merit, Regent, Brandon 123, and Marquis. Nearly all the varieties tested this year have been previously tested, but retesting is important. It provides an opportunity to discover whether a variety's quality will hold up under varied conditions of weather and soil.

For many years Marquis was the millers' favorite because it was consistently good. Then came the stem rust epidemics and Marquis was whipped. Ceres followed on its heels. The millers liked it, but came the rust epidemic of 1935 and most farmers throughout the spring wheat belt quit Ceres. That rust year was the first year there was any appreciable quantity of Thatcher. This variety had been introduced with the millers' blessing. They had tested it and discovered it had what they wanted. But Thatcher had, and still has, three faults. (1) It is susceptible to leaf rust. (2) The test weight is a shade lower than some other varieties. (3) The kernel is small.

The small kernel with not quite the color that wheat farmers like was the characteristic which caused Thatcher difficulty in capturing the favor of growers.

Dr. H. K. Hayes, professor of agronomy at University Farm, who is the daddy of Thatcher says: "We know Thatcher isn't the perfect wheat, and, because it isn't, other and better wheats will come along sometime to take its place. Right now, however, it is showing up well all over the spring wheat territory in this country and Canada."

A study of yield trial records in the Northwest will reveal that Dr. Hayes is modest about Thatcher. None of the new varieties has beaten Thatcher much in yield, and none has beaten it in quality. Here is the way the several varieties compare with Thatcher:

Nordhougen: Yields about the same as Thatcher with about the

same degree of resistance to stem rust as Thatcher, and slightly more resistance to leaf rust. Thatcher is superior in milling and baking quality.

Renown: Yields somewhat less than Thatcher, although more resistant to both stem and leaf rust. Milling quality is inferior to Thatcher.

Apex: Yields definitely lower than Thatcher. About as resistant to stem rust as Thatcher and more resistant to leaf rust. Milling and baking quality inferior to Thatcher.

Rival: A new variety released to North Dakota growers last year. Not as resistant to stem rust as Thatcher, but more resistant to leaf rust. During four years at Fargo Rival yielded the same as Thatcher in 1936 and 1937 and better than Thatcher in 1937 and 1938. Straw is not as strong as Thatcher, and in some years there is a tendency to shatter. In milling and baking tests Rival ranked close to Thatcher in 1937 and 1938 and below Thatcher in 1939.

Pilot: Only moderately resistant to stem rust, but more resistant to leaf rust than Thatcher. Yields have been about the same as Thatcher. In milling and baking quality it ranks close to Thatcher.

Brandon 123: Limited trials have shown it yields less than Thatcher. Definitely inferior to Thatcher in milling and baking quality.

Coronation: Generally does not equal Thatcher in yield, and is definitely inferior to Thatcher in milling and baking quality.

For North Dakota, T. E. Stoa, agronomist of North Dakota Agricultural College, sums up the various test records this way:

"Because Thatcher resists stem rust satisfactorily and is grown widely so that seed is easily available, it may be considered the first variety choice. The best use of Ceres limits it to areas where rust injury is not common. Where Renown is desired, this choice would be principally because of a desire for a wheat of higher test weight, better color of kernel and better appearance than Thatcher. If Nordhougen were grown in preference to Thatcher it would be because of a desire for a beardless variety which grows taller than Thatcher and which, therefore, can be harvested easier.

"Rival and Pilot are to be regarded at present primarily for supplementing Thatcher. In the next two or three years they will indicate more closely their probable place in our farm production."

Water Heaters for the Small Dairy

Condensed from Electricity on the Farm

J. M. Fore

Agricultural Engineer

WATER heating is an operation which must be considered by all dairymen. In the smallest dairies, or on farms where only a few cows are kept, the job of washing milk pails and separator parts may be done in the kitchen. In this case dairy water heating is a kitchen job.

Farms selling whole milk or cream to the public have an obligation as well as a job in cleaning utensils. City and state health departments in an increasing number are applying stringent regulations for the sanitary handling of dairy products. The reason is that while milk and its products are perhaps our best foods, they are also ideal breeding grounds for disease germs when precautions are not taken to exclude them. Thorough washing and sterilization of utensils is one of the first sanitation requirements of health departments, which means hot water is almost a necessity.

Large dairies having many bottles, cans and other utensils to wash and sterilize usually find it most economical to provide steam and hot water with a steam boiler. One may get away from part of the fire hazard, dirt and attention necessary for a steam boiler by using an electrically controlled oil burner in place of coal or wood. Still better, where rates justify it, is the completely automatic electric steam boiler.

Middle sized dairies and general farms where there is no full-time milk-room man have a choice of several automatic electric water heaters and sterilizers. There is the steam accumulator regulation household type water heater connected to the water system, in sizes from 10 to 100 gallons; and various cabinet type sterilizers which produce steam.

It is to the smaller farm, however, where requirements call for hot water and where milk volume does not warrant large expenditures of time or money, that this article is directed. You may not be justified in buying a steam sterilizer, but you can do a pretty satisfactory job of cleaning and sterilizing if you have plenty of hot water—not the kind that cools off in the teakettle while you carry it from the house, but

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hot water at hand in the dairy.

Realizing this need of dairymen, Purdue University has been making studies of different types of small electric water heaters in the laboratory and on Indiana farms. These tests were under way from 1930 to 1938. Records were kept during all seasons of the year, the co-operating farmers noting the number of gallons used, temperatures before and after heating and the electricity consumed.

There are three general types of water heaters suitable for small dairies or other places where from 2 to 10 gallons of hot water are needed at one time. These are all non-pressure types; that is, they are filled with a bucket or hose or under a faucet, but are not connected to the plumbing.

1. Portable immersion heater. Heaters of this type may be plugged into 115 volt circuits and are rated at from 500 to 1,300 watts. They have the advantage of being usable in any available container such as a pail or milk can, but the disadvantages of having no heat control, being more likely to burn out, and of causing rusting of cans or pails. Cost $7.50 to $20.

2. Open tanks with built-in heaters. These may be uninsulated portable containers or larger insulated heaters with or without automatic control. These are filled from the top and hot water is drawn from the bottom. Cost $8 to $50.

3. In-and-out heaters are newer and a little more fool-proof. The tank is thermostatically controlled and is insulated. In order to get the water out after it is heated, you pour in cold water which goes to the bottom and forces hot water out the top. The tank is therefore always full of water. This means you will always have hot water and there are fewer chances for burned out heating elements. Cost $22 to $50.

The cost of electricity in a number of these installations has been little if any more than oil or coal formerly used for heating. Results of studies of these heaters and others in the State are given in the accompanying table. The last column at the right gives a comparison of the electricity which would be used by each of the heaters in raising the temperature of 10 gallons of water 100°. Heater (1) used the most electricity in spite of the fact that the sides and bottom of the tank were insulated; but note that it contained only a 500 watt heater in an 8 gallon tank. It might be inferred then that slow heating with a low wattage element takes more electricity unless the tank is very well insulated. Heaters (6) and (7) used the next largest amounts. Both tanks were uninsulated and with moderate sized heaters. Heater (2) used the least

electricity. It was well insulated all around and had a 2,000 watt element. The average electricity consumption of all the heaters was about 3.4 kw-hrs for 10 gallons of water raised from 70° to 170°.

Hot water requirements for dairies are approximately 7 to 10 gallons per day for each 10 cows. Where more than 20 cows are kept, or where bottled milk is sold, the water requirements are somewhat higher and larger heaters than those listed should be used.

Farm Tests of Water Heaters Between 1930 and 1939

Heater Size Watts	Tank Size Gals.	Tank Insulation Location	Temperature Increase ° F	Heated in Test Gals.	Electricity Used Total Kw-hr.	For 10 gals. raised from 70 to 170° F. Kw-hrs.	
500	8	Sides and bottom only	106.7	4232	1884	4.17	(1)
2000	5	Top, sides, bottom	137.3	1128	424	2.74	(2)
2000	5	Top, sides, bottom	129.3	3564	1522	3.30	(3)
5000	15	Top, sides, bottom	134.4	333	135	3.01	(4)
2000	5	None	111.3	168	53	2.82	(5)
Varied	3	None	109.6	590	258	3.99	(6)
1250	..	None	71.4	1267	343	3.80	(7)

Termites have been found in every state except North Dakota.

Out-of-Season Brooding

Condensed from American Poultry Journal

Fred P. Jeffrey

POPULAR sentiment in favor of a system of out-of-season hatching has been based on two facts, namely: (1) an inefficient use of the laying house due to heavy mortality; and (2) a desire to make more efficient use of the brooding equipment.

As an alternative to hatching out of the normal season, some poultrymen have found by dividing the hatching equally between February and May they can maintain a full capacity in the laying house. Others have solved the problem by utilizing the brooding units for laying birds during the season of the year when no brooding is done. This latter plan involves a program of heavy culling at both the growing and laying stages and a fairly long hatching season.

An experiment to study the effect of date of hatch on chick livability, rate of growth, cost of pullet production, egg production, egg size, and profit in the laying house was started in 1936 at the New Jersey Agricultural Experiment Station. Some preliminary results based on three years of pullet production and a two year average of results in the laying house are presented here.

The plan of the experiment was to start groups of approximately 300 S. C. W. Leghorn chicks at five periods scattered throughout the year—January 15, April 1, June 15, September 1 and November 1. All chicks came from the Station strain of Leghorns, which were being bred for a variety of points not associated with high egg production. Most of the chicks were pedigreed, but in certain November and January hatches it was impossible to get sufficient pedigreed chicks. In these instances, eggs were selected from pen matings of birds in the project. The factor of breeding was, therefore, as uniform as could be arranged.

Electric brooding in non-insulated wooden range houses was practiced throughout. It is significant to note that the June chicks required more than three times less electricity than the January chicks.

Chicks were started on the N. J. Experiment Station laying mash and continued on the same feed as long as retained in the project. An extra 5% of alfalfa leaf meal was fed in the mash for the first four weeks. Grain was hand fed twice daily for the

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Date of Hatch	Feed consumed to 24 wks. Mash	Grain	Totnl	Body wt. at 12 wks.	24 wks.	Mortality to 24 wks.
	lbs.	lbs.	lbs.	lbs.	lbs.	per cent
January 15	9.2	11.0	20.2	1.6	3.1	19.9
April 1	9.2	9.6	18.8	1.6	2.9	12.2
June 15	7.3	11.3	18.6	1.4	2.9	11.8
September 1	8.6	13.2	21.8	1.5	3.0	8.5
November 1	8.6	13.9	22.5	1.5	3.2	16.5

first six weeks and then hopper fed (equal parts of whole wheat and cracked corn) from six to twenty-four weeks. Hopper feeding was practiced in the laying house, that is, birds had access at all times to mash, cracked corn, and whole oats.

Figures showing grain, and total feed consumption, mortality to twenty-four weeks of age and body weight per pullet at twelve and twenty-four weeks of age are given in the accompanying table. In brief, it is seen that the November and January hatched pullets grow at a more rapid rate because of the cold weather prevailing during their growing period. The April and June hatched pullets grow more slowly and, as a result, consume less feed per pullet. Since all chicks were given free range at all times, it is reasonable to assume that the spring hatched chicks saved a little on the feed bill by consuming relatively more green grass as it was available to them in large quantities.

Our experience in growing period mortality is somewhat contrary to general recommendations in that the June chicks showed excellent livability. The September and June chicks lived better than those hatched at other seasons. Brooding conditions in June and September are characterized by being warm and dry with plenty of sunlight available. No coccidiosis outbreaks were noted in these hatches in a 3-year period.

Cash cost per pullet raised for the different hatches was calculated and included cost of chick (hatchery prices were used as follows: January, 16c; April, 15c; June, 14c; September, 15c; and November, 16c), electric cost in brooding (3c per KW hour), cost of feed (average retail price in New Jersey), and rate of mortality. Receipts from sale of broilers at the 2 pound level were included in the calculations. June pullets were cheapest to raise (50c per pullet) and November and January pullets the most expensive (87c per pullet). April and September pullets cost about 70c each.

For a full laying year (24 to 76 weeks of age inclusive), the birds from all the hatches received 15 hours of light. Birds were hopper fed mash, corn and oats, and no

supplements were given at any time. No culling was practiced during either the growing or laying periods, and laying house mortality was about the same in all the hatches. The ratio of grain to mash consumed by laying birds was approximately 2 to 1, that is, with an average feed consumption per bird of 81 pounds, 54 pounds were corn and oats, and 27 pounds were mash.

All eggs were shipped at the time of trapnesting and their value calculated on the basis of the average price received for white Grade A extras and mediums and white pullets and pee wees at the Flemington, N. J., auction market. Likewise, the value of the birds as fowl at the end of the laying year was calculated on the basis of prices prevailing at Flemington.

On the basis of a two-year average, the April hatches laid the greatest number of eggs per bird (hen-day basis)—172. The June hatches averaged 166 while the September, November, and January hatches averaged about 151 eggs each.

In calculating labor income, the following were considered: (1) cash cost of pullet production; (2) laying house profit (total value of egg receipts, plus value of birds as market fowl at the end of the laying year, minus feed cost). It was found that the April and June hatches were equally profitable, returning about 35c more per bird than the September or November hatches. The January hatched pullets proved the least profitable by returning 45c less than the April or June hatched pullets.

In conclusion the following points should be emphasized:

(1) November and January pullets cost more to produce.

(2) September pullets proved easy to raise and showed the lowest mortality during the growing period.

(3) April and June pullets returned the highest profit.

(4) Five widely separated hatches are not recommended either from the standpoint of efficient use of buildings or equipment or from the standpoint of disease control. A combination of two hatches separated by a 3-month period should allow for efficient use of brooding and laying equipment and at the same time prove more advantageous from the standpoint of disease control. Some of the preferred combinations now being practiced include: February and May; March and June; and April and September.

Control of Soil Erosion

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CONTROLLING erosion is of utmost importance on upwards of one-half of the cultivated soils of the United States. Another century of uncontrolled soil erosion might reduce the acreage of productive soil to a point where the land could not feed well our present population. Even casual observation of our more badly eroded sections reveals the real damage that has already been done. Once erosion is well under way, it tends to become worse with increasing rapidity.

Plant nutrients may be returned to depleted soils and their productivity restored. Time will be required, however, for such restoration, once the organic matter and nitrogen have been badly depleted.

If the surface soil washes away, it is gone forever. The finest particles are usually carried all the way to lakes or to the sea and only the coarser material remains on which to grow crops. Phosphorus and potash may be restored to a soil, but we know of no feasible way of collecting and returning soil to a field from which it came. It is imperative in the interest of the nation as a whole, therefore, that soil erosion be brought under control as completely and as early as possible.

Maintaining high productivity by all means is essential for the control of soil losses by erosion.

On the basis of the average yearly losses, erosion would carry away the surface 7 inches of soil from a fallow field in 25 years, from continuous corn in 50 years, from continuous wheat in 100 years, from a rotation of corn, wheat and clover in 370 years, and from blue grass in 3000 years.

Productivity and Soil Cover

Plants on a productive soil grow large root systems whose rootlets occupy the soil completely and hold it together. Moreover, plants on such soils grow large tops which, in turn, protect the soil against washing. Such annual crops as cotton, corn and spring grains leave a large quantity of residues on productive soils. In addition, the aftergrowth of hay plants aids greatly in the protection of the soil against the beating action of rain drops and also against the action of alternate freezing and thawing, and on the lighter soils against wind action. The organic matter from these

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residues is helpful in all of the ways stated in the previous chapter. The specific ways and means of building up and keeping up the organic matter in soils was discussed at the opening of this chapter.

Tillage in Relation to Soil Erosion

Under the term tillage is included plowing, all kinds of harrowing, and any other methods of seedbed preparation, seeding itself, and cultivation. Depressions, however tiny, are left in the surface of the soil by the different tillage implements. If tillage is done up and down slopes, the depressions may lead to gully erosion. If, however, tillage is on the contour or across slopes on the level, the depressions catch and hold water which soaks into the soil and consequently no erosion results.

Plowing on rolling lands may well be done a little deeper than ordinarily. Thus water is absorbed and less erosion is the result. Dead furrows, the final open furrow left in plowing, up and down hill are the direct cause of many bad gullies. The tiny furrows left by harrows on slopes frequently lead to the formation of rills. If these unite, a sizeable gully may easily form. Seedbed preparation seldom needs to be done up and down hill for the purpose of smoothing the surface. Later stirring that is to be untouched for any length of time must, for the sake of safety, be done on the contour. And for these reasons all cultivation of such crops as vegetables, corn, cotton, beans and potatoes ought to be done on the contour.

Crops in Relation to Soil Erosion

Crops vary greatly in the degree to which they permit or prevent erosion. Most of the regular crops fall into one or two classifications, close-growing and clean-tilled crops.

Most of the crops grown for hay, small grain, and pasture are classed as close-growing. Among them are wheat, oats, rye, barley, alfalfa, clovers, hay and pasture grasses, and such annual hay crops as millet and sudan grass. The individual plants of these crops are so close together that they protect the soil rather completely against the beating of raindrops. Buckwheat, although a somewhat close-growing crop, fails to protect the soil against erosion. This crop occupies the soil only about two months, leaving it bare and exposed to erosion the rest of the year. It should not be seeded on steep slopes. Much of the American commercial supply of this grain, however, is grown on land with slopes steep enough to be susceptible to rather severe soil washing under unfavorable conditions.

Crops that are to be cultivated are planted in rows from less than two to more than four feet apart. Considerable soil between the rows, therefore, has no crop

protection. Moreover, cultivation keeps the surface inch or two of soil in a loose condition that washes very easily indeed on relatively steep slopes. Clean-tilled, or clean-cultivated, crops include most garden vegetables, field-grown beans, cabbage and potatoes, and corn, cotton and sorghum. Erosion is often severe in late potatoes in the northern states. The washing takes place not so much while the crop is growing as it does after it has been harvested. Either machine or hand digging leaves the soil soft and smooth. In New York, Maine, and other northern states it is usually rather late to obtain any appreciable growth of any close-growing or cover crop for the purpose of protection after the potatoes are harvested. Machine digging, in particular, leaves the soil soft and so smooth that sheet washing may readily take place. On such potato land any treatment that produces contour ridges would be beneficial and should usually not be too costly.

In the Corn Belt a typical rotation is corn the first year, oats the second, and clover the third. A second year of corn is often grown on the better corn soils, thus making a four-year rotation. In the East, potatoes, cabbage, or beans the first year; oats or barley the second; clover the third; and timothy the fourth is a common rotation. In the South, cotton the first year; spring grain the second; and corn the third are grown, legumes being used to some extent for winter cover of the soil. Cowpeas for hay may be added as a fourth year. In the Southwest, a grain sorghum such as kaffir or milo may be grown in the first year, barley or oats the second, and wheat the third and the fourth years. The addition of sweet clover or lespedeza is highly desirable in the areas to which they are well adapted. The rotation should be such as to aid in the maintenance of high crop yields and high organic-matter content of the soil, and at the same time to aid in the protection of the soil against washing.

Seeding Across Slopes Essential

Seeding crops across slopes or on the contour aids in the holding and absorbing of rainfall. If the rainfall could all be absorbed no runoff and no soil washing could take place. Up-and-down hill rows permit unimpeded runoff, but contour crop rows, on the other hand, check the flow of water down the slope. Thus by holding the water on the soil for a longer time, more of it soaks into the soil than with up-and-down hill rows. Moreover, the crop plants themselves check the speed of runoff water and thus reduce its cutting and carrying power. Contour seeding, therefore, eliminates rill washing and controls gullying in a large measure.

Strip Cropping on the Contour

By strip cropping is meant the growing of crops in belts or bands across slopes. By this means a long slope is broken into a number of strips. No two adjacent strips are planted to clean-tilled crops at the same time. In fact, it is common practice to alternate clean-tilled with close-growing crops such as clover, hay grasses, oats, or wheat. In this way only half of a slope is planted to the more erosive crops at any one time. Any water that is not absorbed by the meadow strip immediately below it may be caught, held and absorbed by the cultivated strip. In case of ridged potatoes or corn, these crops may catch and hold water coming from the strips or close-growing crops.

For the best control of erosion, strips must be kept definitely on the contour and the crop rows planted on the level. Unless this is done, water collects between the rows and flows toward the lower end. As a number of rows cross an up-and-down-hill depression, such as an old gully, sufficient water may collect to start a new gully, or to re-open an old one. While strip cropping can not control sheet erosion completely, it is a definite aid in the prevention of both gully formation and sheet washing.

The best width of strip to use varies with the length and steepness of slope, the rate of absorption of water by the soil, the type of rainfall—slow or heavy showers—the value of the land, and value and nature of the crops grown.

Diversion Ditches

As strip cropping breaks one area into a number, so the use of diversion ditches makes a number of small drainage areas out of a large one on a long slope. Ditches are laid out with slight fall from one end to the other. The water from the land directly above each ditch flows slowly around the hill to a prepared outlet. Safe outlets that do not wash may be developed on a stiff sward or turf, in brush, or in forest.

Small diversion ditches may be placed at the lower edge of each contour strip. More often, however, they are placed below each third, fourth, or fifth strip, depending on local soil and slope conditions. Sometimes these ditches are used to drain a wet area or to protect a steep part of the slope. Once water is collected in a ditch, it must be looked after so that gullying cannot follow.

Terraces

Terraces are a refinement and a very great improvement over the hillside ditch. A crude terrace had been used for some years in the Southeast, but it was Priestly H. Mangum who first built the terrace that bears his name. This first terrace was built by him more than fifty years ago and it

is still in use. The Mangum is a broad-based ridge from fifteen to twenty-four inches high with a wide water channel above it. The water that collects in the channel from its drainage area is carried at a slight slope around the hill to the prepared outlet, as is the diversion ditch. The Nichols terrace, an improvement over the Mangum, is rapidly coming into general use. Terraces are used more generally in the South, Southwest, and Midwest than in other sections of the United States. Some terraces, however, have been built in the Northeast and in the upper Mississippi Valley. Contour farming and sometimes contour strip cropping is practiced on terraced land.

Contour Furrows

The contour furrow is a variation of the diversion ditch. These furrows are laid out on the exact contour or level and for the purpose of holding water. Such furrows must have no slope lest the collection of water in them cause washing where none was taking place before. Pastures are benefited by the water held by these small elongated ponds. One and even two inches of rain may be held against runoff and by soaking into the soil helps in the production of feed during dry periods. When a sufficient area is contour-furrowed, springs that have long been dry may flow again.

Gully Control

It is always advisable to fill or to bring gullies under control as soon as possible after they have formed. In gully control, use is made of the knowledge that reducing the speed of the current lowers its cutting and carrying power. Placing in gullies materials that slow the current aids in gully control. Straw, fine brush, and trash of various kinds are especially effective in small gullies. The trash used may well be staked down in order that heavy rains may not wash it away. As brush or straw check the current, the coarser material moved is deposited and in time fills the gully.

The seeding of various grasses and legumes and the planting of ordinary native shrubs and of such leguminous ones as (*amorpha fruticosa*), Scotch broom (*cytisus scoparius*) and rose acacia (*robinia hispida*), and of the black locust (*robinia pseudoacacia*), and other trees, all of them in the areas of the country to which they are well adapted, aid in the control of gullies. Shrubs bearing food for man or for wildlife may well have preference. Representative of these are blackberries, raspberries, and hazel nuts. Nut or fruit trees deserve some consideration after leguminous trees. Covering the bottom of gullies with large stones checks washing. Earthen, log, stone and concrete check dams are sometimes used. All of

them should be built under the direction of an erosion-control engineer because unless they are rightly placed and correctly built, dams may do more harm than good.

The above is an excerpt from Conservation in the United States by Gustafson, Ries, Guise and Hamilton, which we recommend as an excellent book in its field, with especial emphasis on Erosion Control. It is published by The Comstock Publishing Co., and for the convenience of our readers may be purchased through the Farmers Digest. Price $3.00.

Bran Beats Cottonseed Meal

Condensed from Kansas Farmer

GATHERED at Hays for the the 27th annual Cattlemen's Roundup, April 27, several hundred Kansans heard how $22 worth of wheat bran made as many pounds of beef as $37.50 worth of cottonseed meal. Reporting on results of cattle feeding tests at the Hays Experiment Station, Dr. C. W. McCampbell told that 2 pounds of wheat bran had proved equal to 1 pound of cottonseed meal as protein supplement in feeding stock calves.

Average cost of cottonseed meal during the experiment was $37.50 a ton. The wheat bran, purchased at $11 a ton, gave by far the most economical gains. With 2 pounds of wheat bran doing the job of 1 pound of cottonseed meal it is easy to decide which to feed. Bran will be the most economical gain producer just as long as the price is less than half the price of cottonseed meal.

Results of the test indicated also that 3 pounds of wheat bran produced appreciably more gain, and 1 pound of bran produced less gain than 1 pound of cottonseed meal. In a test with yearlings, 2 pounds of wheat bran produced significantly more gains than 1 pound of cottonseed meal. Atlas silage was fed with the different protein supplements.

Gains of another lot receiving alfalfa as the protein supplement, indicated that 3 pounds of alfalfa hay are equal to 2 pounds of wheat bran or 1 pound of cottonseed meal. Grinding the 3 pounds of alfalfa hay did not increase its feeding value, either for the calves or for the yearlings.

Dr. McCampbell explained that the protein problem is the most important problem confronting Kansas cattlemen of today. He declared that feeders who neglect to provide necessary protein rob themselves of considerable net return.

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Milk by the Jugful

Condensed from The Ohio Farmer

E. W. McMunn

AKRON consumers now take their milk in large orders! Starting the middle of last December when the dairies introduced gallon jugs into their retail sales program, consumer acceptance has been so rapid that today over 60 percent of the fluid milk sold in that market goes into homes in the glass gallon jug.

This revolutionary method of marketing milk is being watched with keen interest by other large markets of the state.

No one in the market is prepared yet to say just what the outcome of this experiment will be, but everyone is agreed on at least one point—consumption of milk has gone up. The best figures available indicate that total consumption of fluid milk for March was 17 or 18 percent over the same period of 1939. At the same time there has been no slump in demand for cream and manufactured dairy products.

Introduction of the gallon jug, however, is not alone credited with this phenomenal jump in fluid milk sales, for with the jug has come a price at present of 25 cents a gallon at stores or 27 cents delivered from the wagon. Quarts sell at 10 cents, whether bought at the store by a customer and carried home or delivered by the milk driver. Thus, the consumer can buy a gallon of milk by the jug for the same amount of money as he would pay for 2½ quarts by the quart. Therefore, this price situation has been a big factor in the consumption gain.

Gallon jugs for the sale of milk are not entirely new. Starting in the early 30's, during the worst of the depression, roadside stands and farmers outside of Akron, and other markets as well, offered milk in gallon lots at low prices to customers who would come to the farm for their supply. In cities like Akron there even developed clubs of six or seven neighbors who would take turns, possibly one day each week, to go out into the country and bring back the milk supply for the whole group. In the city it was divided for the individual families. Milk sold on the farm did not have to meet city health inspection.

Later in the Akron market milk depots developed where customers could buy in gallon lots milk that had come from in-

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spected farms and was sold over the counter at 30 cents a gallon. Customers flocked to this new supply at a lower price and the distributors were forced to take some drastic action or lose their customers.

When the Akron distributors adopted the gallon jug to meet this competition they set a price of 33 cents from the wagons, or two cents over the store price. Later the "cash and carry" price dropped to 25 cents and the delivery price to 27 cents.

Distributors have had their headaches with this new marketing method. Present bottling machinery in most cases is not adequate for bottling gallon jugs. Without adequate automatic machinery, they have had to fall back on more hand labor in filling the bottles. Speed has been lost in the operation.

Present bottle washing equipment is inadequate in many of the plants, and here again has come the need for more hand labor. Most of the automatic bottle washing machines will not handle the gallon jugs. A lot of hand brushing is now necessary to get the jugs clean.

With the gallon jug of milk at a low price in the Akron market, customers that formerly ordered one quart every day, or two quarts a day, may now order a gallon every second or third day.

"We have probably made bottlers of 50 percent of our customers," said one distributor. "They will buy a gallon of milk every second or third day, keep our quart bottles and use them to pour the gallon in before putting it into the refrigerator."

A jug deposit of 10 cents is required by handlers but there has never been a bottle deposit for quarts in this market.

Apparently, at least to the present time, customers are well pleased with the gallon jug at a low price. This is especially true of those families that can use a gallon of milk every day, or at least every second day. With the arrival of warm weather and increasing danger of souring there will come a test of satisfaction among the small users consuming a quart or even less every day.

Other changes too have come to the Akron market. Early in February distributors stopped all Sunday deliveries and started all deliveries at 7.30 in the morning. No longer do drivers start out, sometimes almost in the middle of the night.

With the six-day delivery came some difficulties in determining just how much milk to bottle to take care of the extra demand on Saturday and Monday. In the main, customers did not object to this change. Consumption did not appear to suffer, in fact some dealers found that customers would double their order for Saturday then come back on

Monday for more than they had formerly bought.

To spread out the demand over week-ends drivers have encouraged customers to order extra milk as early as Friday and thus to spread the order out so total demand equalizes itself over the week-end period.

Economy in Feeding for Squab Production

Condensed from New Jersey Agriculture

C. S. Platt
Associate Poultry Husbandman, and Supervisor of State Pigeon Breeding Test

EVER since pigeons have been confined for the purpose of squad production the practice has been to provide a variety of grains in the feed. It has been thought that such a variety would prevent any nutritive disorders that might be brought about through interference with the bird's natural food habits, and the needs of the birds for grains of different sizes could be met best by using various grains. Of the two factors, size probably has been more important than nutrient qualities, as small grains like milo, millet, hemp, kafir corn, and hulled oats proved satisfactory for squabs when they were first hatched, whereas grains such as wheat, Canada peas, and whole corn were found suitable as squabs approached maturity.

Investigators in the field of nutrition of pigeons have paid little attention to the problem of the kinds of grains needed, although a report published in 1924 indicated that pigeons fed exclusively for six months on popcorn, sunflower seed, or buckwheat did not lay any eggs; those that received barley, Canada peas, hemp, kafir produced some eggs, but none hatched; those that received corn or oats produced squabs, but they did not develop normally; and birds that received wheat and rye as exclusive diets were the only ones to rear squabs to maturity. Because of the lack of accurate knowledge regarding the suitability of simple mixtures of grains in pigeon nutrition, a study of the problem was started by the Experiment Station in connection with the work of the New Jersey State Pigeon Breeding Contest at Millville.

The first phase of the study was to observe the effect of restricting the diet of a squab-producing breed, the White King, to corn and wheat. Pairs of breeders that had produced for one year on a standard diet were used. The results proved that pigeons fed only these two grains would remain in normal health, produce eggs that would hatch, and successfully rear squabs. The

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grains were mixed in the proportion of one part of whole yellow corn, one of cracked yellow corn, and one of wheat by weight. The mixture was kept uniform throughout the year, no seasonal variations being made. The only significant difference between lots of pigeons maintained on a normal diet and those fed corn and wheat was in the weight of squabs when they were prepared for market at 28 days of age. At this time the squabs from birds receiving the restricted diet were the smaller.

In an effort to increase the weight of the squabs, the ration was changed the following year by adding 15 pounds of Canada field peas to 85 pounds of the whole corn, cracked corn, and wheat mixture. The effect of this addition was immediately noted in the weights of the squabs, normal development taking place within the 28-day growing period. Adding the peas to the diet also shortened the length of time between egg clutches. This might be attributed to an earlier excitation of the reproductive urge because of more rapidly maturing squabs.

The use of the Canada peas greatly increased the cost of the feed, however, so a change was made the next year by substituting the Alaskan green pea for the Canada field pea. This change proved to be entirely satisfactory, with the result that a ration has been developed which will grow squabs at a normal rate and at a much lower cost than when a variety of grains is fed. At present a suitable ration can be made with a mixture of 100 pounds of whole yellow corn, 100 of cracked yellow corn, 100 of wheat and 35 of Alaskan green peas. The cracked corn furnishes the smaller particles of grain needed in the early growth period of the squabs, and the whole grains provide the later needs.

Additional improvements in the ration may be made in the future, particularly in regard to the amount of peas, as there is some indication that more could be used to good advantage. There is also the possibility of substituting some of the varieties of cowpeas for the green peas. Peanuts, likewise, have the possibility of being used as a substitute.

Fundamentally, the need of pigeons for squab production seems to be met by a diet of corn and wheat, supplemented with some grain of a higher protein content, such as Canada field peas, Alaskan green peas, cowpeas, or peanuts. Soybeans, also a high protein grain, have not proved satisfactory.

With the lowering of feed costs made possible by the use of just a few essential grains, the producer of squabs at present at least can maintain his flock and hold it over until more prosperous days return.

Haying in the Rain

Condensed from The Michigan Farmer

S. T. Dexter

Department of Farm Crops, M. S. C.

THERE is a knack in putting up alfalfa and grass silage. You can learn lots of tricks not only by watching and talking with the other fellow, but by doing the work yourself a few times. One of our Michigan farmers who has put up alfalfa silage for several years decided last year to fill two silos without the use of molasses. He had seen that our silage at the experiment station, put up without molasses looked pretty good, and his molasses silage had always been good, so why not try it. It turned out fine. But he had already been successful at making alfalfa silage. We did not recommend it to him, and certainly wouldn't to a beginner.

Just today I got the report that another of our thoroughly experienced men thinks he can fill a silo with alfalfa silage with less expense than he can with corn. Well, he's not the first farmer to come to that conclusion. And there are others who are sure that they can put a field of alfalfa into the silo with less expense and less bother and a lot less loss of nutrients than if it were put in the mow.

There is no doubt that the alfalfa crop may be put into the silo without much loss and with great rapidity when things go right. If you can keep the loader going most of the time, and don't have breakdowns, your tonnage in a day really amounts to something. Showers on half-cured hay and poor drying weather upset the best of haying schedules while in silage making it is mostly up to you.

There are about three tons of silage to handle in place of one ton of hay. This means more hauling, and a lot of heavy hand labor. We used a device last summer to dump the loads from the trucks. Just a length of woven wire, fastened to the back of the truck, running along the bed and up over the cab. You fasten the loose end to a chain that is anchored fast to something, and simply drive away, rolling the load off. This takes almost no time at all, makes the pitching easier, and leaves the rig free to go and get another load. Some of the men get along without a man on the load, when loading with a truck. It is easy to put on about all you can haul without much

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loading. According to all we know now, it seems desirable to keep someone in the silo, tramping and spreading the cut material evenly.

Three of us went out a few days ago to see a trench silo full of sweet clover silage. This was put in over a period of about 3 weeks, they told us, using 60 pounds of molasses per ton. This was a big trench, probably more than most farmers would want. It was 12 feet wide on the bottom, about 16 wide at the top, and was 9 feet deep, through the body of the trench. In such a trench, there would be close to three tons of silage per running foot, and to avoid spoilage, you ought to feed at least a foot a week. This silage had been covered with about 8 inches of soil, and had kept well. They packed it by driving a team back and forth after every load. The ends were sloped to permit easy hauling and packing of the silage. The cows liked this silage and were doing well on it. From all we could learn, there had been a tremendous crop of sweet clover on the field. They cut it with a binder, and estimated about 10 acres put in the silo. While we couldn't see just how big the trench was, because only one-third or thereabouts was fed out, we estimated about 150 tons of silage altogether. It seemed like a good way to handle a heavy crop of sweet clover that would have made hay only with great difficulty. Since a trench silo costs nothing but labor to build, a good many farmers could well think of using one to supplement their present storage facilities.

We had a little trouble last year with some silage we put up in a 10-foot metal silo. The main trouble was that the packing was poor. In a silo as small as 10 feet in diameter, it probably would be a fine idea to take 4 or 5 days in filling, in order to give ample opportunity for settling. This makes it easy to make grass or alfalfa silage with a small crew on a small farm. You don't need to fill it all in one day, and if you have your own filler, you can fill the silo when you can't make hay. Five or six loads of silage in the morning up until the hay is ready to go in, helps get the hay crop harvested. And in a small silo, there probably wouldn't be a better method. In our other small silo where we filled on two successive days, the packing was a lot better. In the big silos, we have not had this trouble, since it takes longer to fill and the packing is better in any case because of smaller contact with the walls.

Using All the Tree

Condensed from Southern Agriculturist

E. O. Siecke

Director, Texas Forest Service

THE saying, "Woodman, spare that tree," is changing in East Texas these days to "Woodman, use that tree!" And using it, he is. The timber operator is not only harvesting the lower trunk of the tree but is even going after the wood in the tops.

On the use of the topwood hinges one of the most interesting stories and most far reaching conservation developments originating in East Texas forests in recent years. Perhaps it is strange that use of topwood spells conservation. But it does, because complete utilization is the first step in conservation. It means elimination of waste of a great natural resource.

In 1936 the Champion Paper and Fibre Company erected a sulphate mill at Pasadena, Texas, which was to manufacture pulp from Texas timber.

Accordingly, a three-way project was initiated in 1937 by the Texas Forest Service of A. and M. College, in co-operation with the Champion Company and the Texas Long Leaf Lumber Company of New Willard. The lumber company produced the pulpwood from logging tops on one of its cutting operations, the Texas Forest Service furnished the technical assistance and kept the records, and Champion bought the pulpwood and processed it at its mill near Houston. The report came back from Champion—"Topwood suitable for sulphate pulping when cut immediately behind logging, properly knotted and care exercised in selecting tops to be worked."

Today several of the Champion Paper and Fibre Company's wood contractors are cutting pulpwood on a number of operations from logging tops and tie tops. That means a lot, namely, that the project has developed into one of commercial importance, which definitely proves its value.

How does the timberland owner benefit? First, he gains an additional profit from his forest holdings, by utilizing a formerly unmerchantable product. It has been shown that on an average about one-half cord of pulpwood can be made from the tops of every 1,000 board feet of sawlog trees. There are examples of some owners getting as many as

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six or seven 5-foot cuts of pulpwood from the top of one tree. The average is probably nearer four to five sticks of pulpwood per top.

Then, the timberland owner benefits from the reduced fire hazard resulting from the salvage operations. Where before tops lay in a jungled mass, often high off the ground, a dreadful fire trap, the tops remaining after pulpwood has been cut are low to the ground and rot away in a short time. Should a forest fire start, the chances against its flaring up into the crowns of the standing timber are much less.

It should be pointed out here that these benefits are possible for the farmer as well as the owners of larger tracts of timberland. East Texas farmers own about sixty per cent of the forest land in the piney woods section. They are important producers of forest products. Producing pulpwood from logging tops in their timber cutting would afford them an added income from their farm woodlands.

The beneficial effects of salvaging pulpwood from logging tops also mean a lot to forestry in Texas, and other Southern States that produce pine timber. For example, it not only creates an additional value for the timber but also offers opportunities for additional employment of woods labor. Then, probably the greatest benefit of all, it lessens proportionally the annual requirements on standing timber necessary otherwise to meet the pulpwood market demand.

In this respect, the pulp mills cannot be expected to run on wood produced from the central stems of logging tops entirely. Pulpwood from tops, of course, contains more knots than wood cut from the body of the tree and cutters must exercise care in selecting tops, and then make sure that knots are trimmed flush to the body of the stick. This is necessary in order that the bark can be removed in the big barking drums at the plant. The yield of pulp from logging topwood is lower than from clear wood because the knots do not digest properly in the chemical cooking process and are lost on the screens.

There is a great potential supply of topwood available in standing timber in East Texas today. The recent forest survey conducted by the U. S. Forest Service has estimated the wood volume in pine timber of sawlog size to amount to over 41 million cords. Approximately seven and a half million cords of this total volume are in the tops. Foresters estimate that there were over 300,000 cords of stemwood left in the unmerchantable tops of pine sawlog trees in 1938.

It is true that the possibilities of producing pulpwood from logging slash are limited to the areas

from which pulpmills manufacturing pulp by chemical processes are drawing their wood supplies. With the expansion of the industry it may be assumed that new mills can also look to logging tops partially to supply their yards. Within the present pulpmill areas, however, production of pulpwood from topwood is a forward step and a source of new income for a considerable number of people.

Strawberry Clover Spreads Through Western States

Condensed from The Western Farm Life

Joe W. Jarvis

IT looks like clover! It grows like clover! And it is strawberry clover, a perennial pasture plant that grows well on alkali soil. Last year seed was harvested by more than 150 farmers in eastern Oregon, eastern Washington and southern Idaho irrigated sections on about 634 acres. About 77 per cent of this acreage was seeded in the spring of 1939. According to reports, about 2,000 acres in the same sections have been seeded to pasture with strawberry clover.

Pasture seedings are expected to increase because more seed is available. In 1938, about 9,000 pounds of seed were harvested in the Northwest. Last year the production reached 50,000 lbs. The demand is strong and many times this amount of seed is needed for pasture. In Colorado 200 acres have been seeded to pasture in five years.

Strawberry clover is a native of Australia and other countries, but was found on wet pasture land in Idaho, Oregon and Washington several years ago. It is similar to ladino clover, but has proved to be the hardier. The flower resembles white Dutch clover, but is pink. The color fades as the flower head changes to a ball. When mature the ball is about ¾ inch in diameter and resembles a green strawberry; hence the name, strawberry clover.

The foliage is similar to white Dutch clover. It has creeping runners, strawberry fashion, and establishes new plants wherever the nodes contact the soil. The roots are shallow. The pods from the matured ball contain the seed, there being two seeds to each pod. The pods have a tough, silky shell and float easily on water. One thousand or more

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seeds to the plant is not unusual.

Many tests have been made at experimental stations in Oregon, Idaho, Washington, California, Nevada, and Colorado. It has proved particularly adaptable to alkaline and wet soils. One experimental station has reported that strawberry clover is doing well on acid soils as well as tide lands. Reports show that it was grown on tide lands in Australia.

Strawberry clover is attracting much attention as a pasture crop because of its adaptability to alkaline soils and because of its palatability. All classes of livestock like it. At the experimental station at Union, Oregon, the rabbits (which eat only the best feed) pass up other clovers and grasses, going to the center of the field to feed on strawberry clover.

It has been observed that an established stand of strawberry clover will carry 3 to 4 cows an acre. The carrying capacity with other livestock is equally high. Experienced growers report that it will not bloat but publications have stated that it has the same effect as other legumes.

Some farmers have harvested a seed crop and then pastured the clover for a few weeks in the fall. The crop should not be pastured the first year, if it has been planted on poor soil. An established stand can be pastured from early spring until late fall, according to experimental station reports. Rotation or alternating grazing gives best results. One large land owner in the Boise Valley of Idaho planted 200 pounds of seed last spring for pasture.

Good pasture stands have been developed by sowing in other pastures without preparing a seedbed. However, best results have been obtained by preparing a good, firm seedbed, whether it be on salt-grass, alkaline soil or the best land. It should be seeded at a shallow depth, general practice being to seed two to three pounds an acre for pasture purposes. Seeding in rows makes it possible to control weeds while the clover plants are starting. After the clover has once covered the ground, the weeds will be crowded out. Heavier seedings are not objectionable.

Stands of strawberry clover pasture have been developed both by early spring and early fall seedings. In higher elevations, spring seeding has proved to be most satisfactory.

Strawberry clover requires considerable moisture and, if not seeded on low, wet land, should be well irrigated. It offers a real possibility for use on reclamation projects in the West, where there are low and alkaline soils. Hundreds of acres of alkaline soil can be seeded down, converting otherwise useless land into profitable pastures. Strawberry clover will provide feed for more stock

on home ranches, thereby reducing the need for range pastures.

Best results for seed production have been obtained by planting on the better lands, although good seed yields have been reported on alkaline or poor soil. It requires a longer time to establish a good stand of strawberry clover on alkali soil. A firm, well prepared seedbed always gives the best results.

Growers report that one pound of seed an acre, seeded at a shallow depth, in 30- to 36-inch rows, is best for seed production. By seeding in rows, the plants can be cultivated until the clover has spread between the rows and crowded out the weeds. It may be necessary to pull the tall weeds.

The plantings should be kept thoroughly moist until the seedlings are established and then frequent irrigations are necessary, unless the crop is seeded on moist, seepy ground. Results show that if the clover is not kept moist on alkaline soils it will die out. The depth of the root system should be determined by the grower and the clover should be watered to that depth.

A few well-established plants in a field will spread in two or three years until the ground is covered, and this will help to hold the moisture.

Growers indicate that harvesting should take place before the clover is entirely ripe. If left standing too long the stems dry and the heads break off. Good results have been obtained by keeping the clover wet until the harvest, cutting it a little green, and allowing it to cure in small bunches. Good results have been obtained by harvesting plots of an acre or less with a hand sickle or by using a lawn mower with the grass carrier attached.

On an acre or more, it is profitable to purchase a special mowing machine bar, carrier and buncher. All of the larger machinery manufacturers make a special bar for cutting ladino, lespedeza and strawberry or other low-growing types of clover.

After the clover has cured well in the bunch, it should be threshed. It is sometimes advisable to use a canvas or tarpaulin on the hayrack. The clover should be handled very carefully in the field in order to reduce the loss of seed.

Good quality strawberry clover seed is selling for $1.00 to $1.50 a pound, depending on the purity of the seed and the local market conditions. Seed can be supplied by most local seed dealers. If they do not stock it, they can secure it from large wholesale seed companies.

Chick Disturbances of Undetermined Origin

Condensed from New England Poultryman

K. L. Bullis

Department of Veterinary Science, Massachusetts

IN spite of marked advances in our information on the diseases of baby chicks, many cases for which a recognizable cause is not established are examined by the Diagnostic Service. The list of recognized diseases of chicks has been augmented in recent years by studies on avian encephalomyelitis (epidemic tremor) nutritional encephhalomaliacia (crazy chick disease), enterohepatitis (blackhead), perosis (slipped tendons), omphalitis (navel ill, mushy chick disease), paratyphoid infection, ulcerated gizzards, visceral gout caused by overdoses of baking soda, and moniliasis (thrush, sour crop). There are perhaps a few more disease conditions of chicks which might be added, particularly in the nutritional deficiency group, but these have not attracted so much attention in our laboratory.

The troubles referred to in this discussion occur during the first two weeks of life. Additional information on chick diseases, diagnostic tests, and diagnostic criteria will undoubtedly further reduce the number of cases in which a diagnosis is not reached. The cases which we propose to discuss include those in which there is poor growth, mortality, and what appears to be basically a digestive disturbance. Observations over a period of years lead us to believe that about thirteen guesses could be made as to the basic cause. One of the guesses would probably be correct, but the present difficulty arises out of our inability to determine which.

1. Inbreeding is a valuable tool for selecting and improving desirable characteristics in a flock. However, the tool improperly used may result in weak chicks, which show poor growth and high mortality. One of the by-products of inbreeding is poor chicks which are discovered and eliminated from the strain by the process.

2. The feed of the parent stock is an important factor in the development of the chick. One of the results of improper feeding may be chicks of low vitality. Feed lacking in certain ingredients such as vitamins A, D, and G may produce such chicks. However, the hatchability may also be affected by inadequate nutrition. If the hatchability is

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good, the feed of the parent stock can probably be eliminated as a cause of poor livability in the chicks.

3. Infectious bronchitis and perhaps several other factors may weaken the parent stock so that they produce eggs which hatch poorly and the resultant chicks are not up to standard.

4. Improper incubation may be the cause of poor chicks and resultant high mortality.

5. Length of time in the incubator or in the chick boxes may be a factor. A specific figure cannot be given which will cover all conditions, but it has been shown that if chicks are prevented from exercising their instinct to eat for a sufficient length of time, the instinct may be lost. Such chicks may literally starve.

6. Temperature in the chick boxes may be an important factor in the later behavior of the chicks. Overheating and chilling of chicks are usually mentioned in the same breath with a minimum of consideration as to the exact cause and consequences. Chicks which are to be in chick boxes for some time or to be shipped some distances, may encounter a wide range of temperatures. The opening of the proper number of holes in the boxes to meet all conditions is impossible.

7. Brooder temperature contributes to the well being of chicks. Generally speaking, it is probable that more harm is done by too much rather than too little heat. It has been shown that pullorum infected chicks will show more mortality under variable conditions of temperature. Chicks free of pullorum disease can be harmed by chilling or overheating. Apparently a digestive disturbance is set up which is manifested largely by soiling of the feathers below the vent. Temperatures considered to be optimum under most brooders may be too low under certain electric brooders, causing the chicks to stay under the hovers too much and resulting in starvation.

8. Brooder management may be a more inclusive term than is herein discussed. Chicks, especially last of April and May hatched, at about two weeks of age may "go to bed" in corners instead of under the hover and become chilled by morning. This may be particularly true when chicks are brooded under hovers having no attraction light under the hover or other light in the room. Too bright brooding lights at night may cause an excessive consumption of feed. It has been suggested that lighting the brooder houses for long hours increases the incidence of crooked toes.

9. Adequate hopper space is an infinite factor. We sometimes feel that because of inadequate hopper space some of the weaker chicks may not get sufficient feed. Many chicks are examined which have consumed large quantities

of litter, be it sand, shavings, or some other type. It has been our interpretation in most instances that the eating of the litter was a result of weakness in the chicks due to some other factor rather than the cause of the trouble.

10. Overcrowding of chicks is another indefinite factor. It is usually recommended that not over 250 to 300 chicks be placed in one unit. Many growers ignore such a recommendation with apparently reasonable success. On the other hand many poultrymen are finding that the raising of smaller number of chicks in a given space results in nearly as many and far superior adult birds.

11. Carbon monoxide poisoning is a guess which is largely a conjecture. Clear-cut cases of carbon monoxide poisoning are easily recognized and show a high percentage of mortality. An idea which has not been checked is that some brooder houses may contain a small amount of carbon monoxide gas. This amount is not large enough to cause immediate mortality, but causes disturbances in the chicks resulting in stunted growth and later mortality.

12. Faulty ventilation in the brooder house may cause the accumulation of carbon monoxide gas. If not, inadequate or improper ventilation may cause unhygienic conditions, which in turn cause poor growth and mortality.

13. Sexing is frequently advanced as a possible cause of mortality in young chicks. It is conceivable that improper handling in the sexing operation may injure the chicks. However, cases have not come to our attention in which this could definitely be proved.

This list of health disturbing factors is set down for consideration and supplementation. It may assist in arriving at the proper conclusion in cases where chicks show inexplainable poor growth and mortality.

Wet Wool

Wool, still good after sixty-nine years at the bottom of the sea, was found when part of the cargo of a clipper, sunk in Corio Bay, Australia, in 1869, was dredged up recently.

Re-establishing Buffalo Grass

Condensed from Farm and Ranch

William H. Witt

TEXAS farmers, who for years have been checked in their efforts to establish buffalo grass by the expense of sodding and the scarcity and costliness of seed, are now beginning to re-establish this nutritious pasture grass that once covered the plains, through the discovery that the seed can be easily and cheaply harvested and that the grass can be more economically established by seeding than by the sodding method.

Much of the pioneering work of establishing buffalo grass by seeding has been done in recent years in the Soil Conservation Service demonstration and CCC camp areas where farmers have been successful in obtaining good stands of the grass from seed harvested by using ordinary dustpans and stable brooms.

Following the establishment of their original plots of buffalo grass, many farmers collected their own seed to be used in increasing the acreage devoted to this grass.

Early in 1937, when it was decided to use buffalo grass seed to stabilize eroded areas retired from cultivation, to establish new pastures and improve old pastures, the Soil Conservation Service nursery at San Antonio began the job of collecting seed to supply farmers in project and camp demonstration areas.

Civilian Conservation Corps enrollees did the collecting work on established buffalo grass pastures which had been closely grazed. Ordinary house brooms, from which 6 inches of the straw were cut to lessen their flexibility, were used. Later push-type or stable brooms were used which greatly increased the amount of seed material that could be collected by each man. Seed material was swept into shop-made dustpans, poured into burlap bags and hauled to the nursery to be cleaned. Under average working conditions each enrollee was able to collect about 20 pounds of seed material an hour. When cleaned, this 20 pounds of material provided 2 pounds of cleaned seed.

The first year 468 pounds of cleaned seed were collected by hand, an estimated yield of 100 pounds per acre. Considering all expenses incident to the collection and cleaning operations, the cost per pound was 66 cents for cleaned seed.

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During the same year the nursery staff developed and constructed a buffalo grass seed harvesting machine for large scale collection of seed material.

The harvesting machine consists of a 30-inch intake fan which is driven by a 30-horsepower motor. Galvanized pipes lead from the intake opening to the ground, terminating in three nozzles, each of which is 22 inches long with an opening approximately 1 inch in width. Crossbars of welding steel placed in these nozzles prevent large rocks and other material from entering the pipes. The entire machine is mounted on a ton-and-a-half truck. Seed material is blown through the fan into a box where it passes over two screens before it is deposited in a burlap bag. The machine operates satisfactorily on closely grazed pastures which do not contain many stumps and rocks. Approximately 2,000 pounds of seed material may be collected each day with it.

Considering all operating costs, it was found that the average cost per pound for cleaned seed is approximately the same for both hand-harvested and machine-harvested material.

During the calendar years of 1937 and 1938 a total of 20,513 pounds of cleaned buffalo grass seed were harvested under the supervision of the service nursery. Of this total, 14,780 pounds were collected by enrollees in CCC camps of Central Texas and the remainder were harvested with the machine.

Whereas the cost of collecting seed by hand in 1937 was 66 cents a pound, the cost of collecting and cleaning seed by both hand and machine methods in 1938 was only 32 cents a pound.

More than 11,531 pounds of cleaned seed were harvested this year at a cost of only 14 cents a pound, this reduction being due to increased efficiency of collectors and improved methods of cleaning. Plans have been made to harvest at least 12,000 pounds of cleaned seed during the fiscal year 1940 (July 1, 1939 to June 30, 1940) and it is believed that developments in cleaning and harvesting methods will make the cost per pound even lower than 14 cents.

Harvesting costs for the average farmer and rancher should be much less, inasmuch as a great amount of the cost incurred at the nursery is in connection with the cleaning. At the present time an all-crop harvester is being used in the cleaning process.

The most practical and economical method of collecting buffalo grass seed by the average farmer or rancher is that of sweeping seed material with brooms from closely grazed pastures. The farmer can obtain a plentiful supply of seed in a relatively short time by going into

his pasture after a rain and sweeping up the seed where they have collected in riffles. Normally the best seed crop can be obtained in the fall but seed may be collected in the summer or at any time after a good rain. It has been found that material of this kind can be successfully planted with an ordinary cotton planter after it has been passed through quarter-inch-mesh hardware cloth.

One five-acre field at the San Antonio nursery was planted by this method in March, 1937. A picker wheel cotton planting attachment was used and the rows were spaced 36-inches apart. Approximately 25 pounds of seed material were planted per acre. The field was cultivated after planting with an ordinary cultivator and weeded by hand during the spring and summer. At the end of the growing season an estimated 60 per cent grass cover had been obtained. Hand weeding is not necessary if the 'middles" are kept free of weeds and in condition for a quick rooting of the stolons or runners. Loose soil, free of weeds, is important in obtaining a quick cover. Planting in clean soil and cultivating to assist in rapid spread permits the establishment of a complete sod in one or two years as compared with five to ten years where no cultivation and treatment are given.

Although buffalo grass is not ordinarily considered a hay plant, high yields of excellent hay were obtained at the Soil Conservation Service nursery from plantings of this species.

During the last week in July, 1937, a plot 60 x 102.4 feet was planted to buffalo grass seed in 18-inch rows. Seed was planted with Planet, Jr., planter at the rate of 12 pounds per acre, covered one-half inch and rolled lightly. The area was watered immediately after planting by gravity flow irrigation. On September 11, 1938, this plot was mowed with a power-driven mower. The hay was permitted to dry for five days before being raked and an additional five days in the shock. A total of 600 pounds air-dried material was weighed from this plot, which, computed on an acre basis, gave a yield of 4,241 pounds. It should be pointed out, however, that the area where this planting was made was the location of a horse lot for a period of years prior to 1934. It was apparent that the increased yield was due to barnyard manure which had been deposited over a period of time, although yields of more than one ton to the acre have been recorded from plantings made in areas which did not receive additional fertilizers.

During the month of September, 1938, buffalo grass seed material (which had dropped to the ground during the process of cleaning) was planted on a landscaped area of sterile soil near

the nursery garage. The seed material or waste consisted principally of naked caryopses, together with small pieces of cow manure, stone, soil, and other inert matter. The area was watered copiously at the time of planting. An excellent stand emerged and the plants averaged 2 inches high at the time first frost occurred. The plants remained dormant until March, 1939, after which time excellent growth occurred. This area has been mowed repeatedly during the summer months and a good lawn has been obtained. This planting has been particularly outstanding due to the fact that soil for this area was taken from a depth of 1 to 2 feet underneath the surface and as a result was considered practically sterile. No manure or other fertiliizer or other soil was added.

Buffalo grass forms, when not mixed with other plants, a close grayish-green turf which is dominant or is present on much of the uplands of the Great Plains and regions to the south. It is found from Mexico to Canada. It extended itself into the prairies of tall grasses after these grasses were grazed out. On land where it is adapted it is considered an excellent fattening grass for all classes of livestock, and because it cures well on the ground it made palatable feed on the range in the winter. It is a low-growing perennial producing long runners which root at the nodes and has short, often curly leaves. The close-growing plants, when left undisturbed, form a dense mat from 4 to 6 inches thick. The flowers are of two kinds, the male borne above the leaves, the female in heads or burs which drop to the ground when ripe. The seeds (caryopses) are enclosed within the hardened parts of the bur. The bur is considered the seed unit. Seed laboratory records indicate that the weathered burs one or more years old will germinate more readily in field plantings than the newly produced ones and that fresh burs or caryopses should pass through a cold period to obtain quick sprouting.

The world's tallest tree on record is the Founders tree, a redwood 364 feet high, in California.

Research Aids the Farmer

Condensed from New England Homestead

O. M. Camburn
Vermont Agricultural Experiment Station

TO retain the carotene content of roughages is desirable since carotene is the precursor of vitamin A, which in turn is one of the essential factors for animal growth. Carotene has been spoken of as the vegetable form of vitamin A. Although this is not absolutely correct, it is true that animals can obtain carotene from green vegetables or roughages and convert it into vitamin A, either for immediate use or for storage in certain organs for future use. Therefore it is desirable to know the conditions which influence the carotene content of hays and silages.

Dairymen have long recognized that milk produced on spring pasture is heightened in color. For winter feeding they prefer hays with a green color. Forage in the field ready to mow contains more carotene than after being ensiled or cured as hay. During the first six months of storage the carotene content of field cured hays declines rapidly.

Many investigators are determining and studying the carotene content of various roughages; some have used the biological method, others have used chemical methods. The data here presented were determined by following a modification of the U.S.D.A. Bureau of Dairy Industry method. This is one of the more rapid chemical methods as compared with the slower biological method which uses the growth of white rats as the measuring stick.

It is not the intent or purpose to here discuss or compare methods of carotene determination, but rather to compare and discuss the apparent carotene content of the samples, as found, and the percentages of retention.

Alfalfa, red clover and timothy crops for the year 1938 were preserved by ensiling, alone, with molasses and with phosphoric acid, and by making sun cured and artificially dried hays.

At the time these roughages were ensiled or cured as hays, the alfalfa was in the early bloom stage, the clover between one-quarter and one-half in bloom, and the timothy in tip bloom. The silages, sun cured and artificially dried hays of each kind of grass were secured in two consecutive days. An Ardrier (di-

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rect high temperature method) was used to dehydrate the artificially dried portion of each kind of hay.

The silages were preserved in small 4′ x 12′ cylindrical wooden stave silos, with 1000 pounds of field stone on top to provide pressure. Each lot of silage was sampled when ensiled and again when removed for feeding. Cheese cloth bags containing 10 pounds of the preserved grasses were planted in similarly treated material, in the mass in the silo. The hays were sampled when mowed, when stored and after 1, 4, 8 and 12 months of storage. The amount of carotene determined is recorded as so many "gamma" per gram of the original sample. A "gamma" may be defined as one part per million by weight. There are 454 grams in a pound.

When mowed, the alfalfa carried 115 gamma of carotene per gram of dry matter. The alfalfa ensiled without preservative, after 5 months of storage, retained 31% of the carotene of the key sample taken when mowed; when preserved with 4% of molasses, the retention during 8 months of storage was 30%; with 8% of molasses used the retention was 50% after six months of storage; using ¾ of one percent of phosphoric acid resulted in a retention of 57% of the carotene after 8 months of storage. When the first cutting of sun cured alfalfa went to the mow it carried 71% of the carotene of the key sample; after 1, 4, 8 and 12 months in storage 43, 30, 21 and 21 percents respectively were retained. The artificially dried alfalfa hay after it was cooled contained 132 percent of the key sample, with 117, 84, 77 and 30 percents retained respectively after 1, 4, 8 and 12 months of storage. These limited data indicate carotene retention in the following order, artificially dried hay first, phosphoric acid silage second and molasses silage next, with the sun cured hays in last place. The increase in carotene content during artificial drying has not been satisfactorily explained. An excess is also noted in the artificially dried red clover hay.

More recent work has shown that during the curing of roughages, especially in the presence of acids, some of the plant pigments may break down to form other pigments which are extracted with the carotene, thus giving a result which is slightly higher than the true value.

After 47 days, of growth, the second growth alfalfa was cut, at which time it contained 294 gamma of carotene per gram of dry matter. When preserved with 8% of molasses, the retention of carotene was 40% after 8 months of storage; with ¾ of one percent of phosphoric acid used the carotene retention was only 12 percent, for a like storage period.

Here the carotene retention is extremely poor with the phosphoric acid silage as compared to the first cutting. The second growth alfalfa hay (field cured) went into storage with only 15 percent of the original carotene content of the key sample (standing green in the field). After 1, 4, 8 and 12 months of storage the percentages of retention were 10, 11, 8 and 6 respectively. The extreme loss of carotene as this second cutting went into the mow was due to weather conditions, which no man can control (or always foretell). The alfalfa was mowed about 10 o'clock on a clear day, with a gentle breeze, but the humidity was high. About three o'clock that same afternoon a heavy shower of less than 30 minutes duration was immediately followed by a bright sun which bleached the cut alfalfa and accounted for the severe loss of carotene. The second crop of alfalfa when artificially dried went into storage with 7% retention of carotene; after storing for 1, 4, 8 and 12 months the percentages of retained carotene were 65, 52, 33 and 19 respectively.

Red clover in the field had a carotene content of 122 gamma per gram of dry matter. When ensiled without preservative and stored for 4 months it retained 43% of the original carotene. When 4% of molasses was used, the retention was 34% after 8 months of storage; and when ¾ of one percent of phosphoric acid was used, 36 percent was retained after a like storage period. For this one crop the three methods of ensiling resulted in similar percentages of carotene retention. The sun cured red clover hay went into the mow with 57% of the original carotene content; after 1, 4, 8 and 12 months of storage the percentages of retained carotene were 52, 28, 28 and 27 respectively.

After artificially drying the red clover held 104% of the key sample carotene; after 1, 4, 8 and 12 months of storage the percentages of retention were 106, 63, 61 and 74 percents respectively.

Timothy grass containing 145 gamma of carotene (dry basis) when cut, was ensiled without preservative and retained 63% after 9 months of storage; when preserved with 8% of molasses the retention was 57% at the end of 8 months of storage. When this early cut (tip bloom) timothy hay (sun cured) went to the mow it contained 68% of the carotene of the original key sample. After 1, 4, 8 and 12 months of storage, the percentages of carotene retained were 25, 26, 14 and 16 respectively. The artificially dried timothy went into storage with 99% of the carotene retained. After 1, 4, 8 and 12 months of storage the retention percentages were 86, 66, 48 and 45 respectively.

A 10′ x 26′ silo was filled with timothy at full bloom stage and sun cured and artificially dried hays were also secured. The timothy before mowing had 116 gamma of carotene per gram of dry matter. That portion ensiled with 2% of molasses after 4 months of storage retained 31% of the key sample and the 4% molasses silage retained 27%. The sun cured timothy hay from the same field went to the mow with 61% of retained carotene, after 1, 4, 8 and 12 months of storage the percentages of retention were 41, 22, 14 and 16 respectively. These are similar to those percentage retentions for the tip bloom timothy. The artificially dried timothy went into storage with 99 percent of the original carotene content of the standing grass. After 1, 4, 8 and 12 months of storage the percentages of retention were 84, 68, 59 and 61 respectively. These also are similar to the percentages of carotene retention of the early cut timothy hay (artificially dried).

In June of 1937 a field of red clover about half in bloom was slightly wilted and ensiled. At that time the carotene study had not been started, therefore no key sample was taken. The lower half of a 10′ x 26′ silo was filled with the chopped red clover to which 2% (40 pounds per ton) of molasses was added. After 20 months of storage the apparent carotene content was 31 gamma per gram of dry matter. This would have been 25% retention *IF* the green stand of clover of 1937 had carried 122 gamma of carotene as was the case in 1938. The upper half of the same silo was filled with wilted red clover finely chopped (¼ inch) evenly distributed and well packed, without preservative of any kind. This carried 18 gamma of carotene (dry basis) after 18 months of storage. On the above mentioned assumption, the percentage retention was 15.

When the data of similarly treated first cutting alfalfa, red clover and timothy are combined the resulting average retention, after 6 months storage was 46% with no preservative, 30% with four percent of molasses after 7 months storage, 54% with eight percent of molasses after a like storage period and 46% when ensiled with ¾% of phosphoric acid and stored for 8 months.

The sun cured hays, first cutting alfalfa, red clover, and mowings from two fields of timothy, went into storage with an average carotene retention of 63 percent of that present in the standing plants. After one month of storage, the retention was 42%, at the end of four months 26% and at the end of eight and twelve months 19 and 20 percents, respectively. When the artificially dried hays went into storage they showed 106 percent of the ap-

parent carotene of the key samples, after one month of storage 99%, at the end of four months 70% and 61 and 52 percents respectively after eight and twelve months of storage.

When cut, the second crop alfalfa carried more than twice as much carotene, 294 gamma per gram of sample, as did the first cutting of alfalfa (115 gamma), tip bloom timothy (145 gamma), red clover (122 gamma) and full bloom timothy (116 gamma).

Carotene was preserved most satisfactorily by artificially drying, and there was about 60 percent retention after eight months' storage. The sun cured hays showed about 20 percent retention for the same length of storage. Disregarding the kind of preservative, the silages, after seven months of storage averaged 44 per cent retention, which was about twice as much as for the sun cured hays.

For these limited data from one season only, one method of ensiling was not outstandingly better than another for retaining carotene. After about six months of storage the sun cured hays had lost three-quarters, the silages one-half and the artificially dried hays about one-fourth of the carotene content of the green crops. This study is being continued with grasses and legumes from the 1939 crops.

Electrocutors

Two new types of electric light traps which project a bombardment of death rays have been reported. One is a tube which throws off certain colored light rays to attract a definite kind of insect to the source of light, where it is electrocuted. The second type is a combination of light and mirrors which throws directed rays and which, with the help of an odorous bait, lures the insect into an oil bath from which there is no escape. The devices have been tried out, with good results, in a few western fruit groves.

Cornering Fence

Condensed from Successful Farming

Henry Giese and Maxton D. Strong

FENCE, our most neglected farm structure, represents an investment of about $1,500 for 1,600 rods on the average western farm. Its estimated upkeep ranges from 9 to 18 cents per rod annually, a figure that is unnecessarily high because ends and corners are seldom built right. Unless they are equal to the great load they must carry, high depreciation and unsightliness are inevitable.

The first duty of the corner or end structure is to keep the fence taut at all times. To accomplish this result, the structure must be designed to meet a large number of conditions, failure under any one of which would prove disastrous. The member must be strong enough to withstand loads produced by the initial stretching of the wire, or by animals, machinery, temperature changes.

End or corner posts should be of a durable material which will not require frequent replacement and will be strong enough to withstand all applied loads. The diameter of a post need not be large, as this has less effect on the holding power than one would be inclined to believe. A 6″ post if treated to resist decay is adequate for most types of woven-wire fence. Larger diameters are expensive, and more desirable results can be obtained by nailing lugs to the bottom of a smaller post or by using some other type of anchorage. Set the post at least 3′-6″ deep in most areas to prevent frost upheaval. Best size for brace posts for most arrangements is 5″ in diameter, set to a depth of 3′-6″.

The diameter of a wood-compression brace member depends primarily upon its length. For a length of 9′ the minimum is a 4″ round post or a 4″ x 4″ wood member. Round or channel steel braces with formed ends are satisfactory. Long, slender braces tend to buckle under stress.

The wire tension member should be composed of at least two double strands of No. 9 gauge galvanized wire. Attach the brace wire at the ground line of the corner post and at a point approximately 12″ from the top of the brace post. Twist the wires until the corner and brace posts lean slightly in the direction opposite to which the fence is to be stretched. Leave the stick or pipe used in twisting the brace wires

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in place to permit later adjustments of the bracing, if necessary, and to keep the wires from untwisting.

Because of its structural arrangement, the assembly with the brace extending from the top of the end or corner post to the top of the brace post, and the wire tension member stretched from the ground line of the end or corner post to the top of the brace post, has less tendency to fail from upheaval than the cross-braced arrangement. Span lengths less than 9′ should not be used, as the tendency for the end post to be raised out of the ground increases rapidly as the span is shortened.

In a series of tests conducted at Iowa State College on various types of end and corner structures, the double-span proved to be the most satisfactory, being simple, cheap to build, and durable. The wood members should be made of treated material to prevent decay. All of the posts including the wood braces should be 8′ in length. The corner post should be 6″ in diameter, the middle post 4″ in diameter, and the end brace post 3½″ in diameter. The 3 posts should be set 3½′ in the ground and the 2 wire braces should each be composed of 2 double strands of No. 9 gauge galvanized wire. The distance between the centers of the posts is 8′-3″, making an over-all dimension of one rod. Since farmers usually place line posts one rod apart, this second brace post will take the place of the first line post.

Sheep Production Programs

Condensed from The Rural New-Yorker

R. W. Duck

UNTIL recent years most of Indiana's Spring lamb crop was sold on the Fall markets. In a high percentage of such cases the lambs lack finish and weight; they are sold when pasture and stubble are gone, and often when the lambs have not even been holding their own for some little time. In both New York State and Indiana the lamb shows in co-operation with 4-H lamb club members have been a deciding influence in demonstrating the possibilities of properly and profitably fitting lambs before marketing. The Indiana work as reported by Henry Mayo, Extension Animal Husbandman, and F. M. Shanklin, 4-H Club Department, Purdue University, brings out the important fact that market topping lambs could be produced to sell in June at four months of age. For the past 10 years June prices received by farmers have averaged about 20 per cent more than Fall prices. They found that by providing an abundant supply of green, succulent pasture such as the clover, oats, or rape, to supplement permanent pastures during the late Spring and early Summer, it was possible to keep the ewes milking liberally and for a longer period of time, so that the lambs would be fat at weights of 75 to 95 pounds before extremely hot Summer weather arrived. Following this plan the lambs were never weaned but were sold directly off their mothers with little or no grain feeding.

Graining Early Lambs

The excellent results mentioned were obtained by providing a good temporary pasture which resulted in low cost production, because it produced maximum milk flow in the ewes. It has been repeatedly demonstrated by investigators that milk flow of the ewe is always the most important single influencing factor in profitable lamb production. Studies by Ritzman and Davenport of the New Hampshire Experiment Station show as much as 79 per cent difference in gains made by lambs while nursing high and low milk producing ewes. It must also be remembered that during the first 120 to 125 days adequately fed lambs should make nearly two-thirds of their first year's gain and growth. Such maximum rapidity of gain possibilities are correlated with effi-

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ciency and economy. These together with their comparative low maintenance requirement operate to produce greatest profits with lambs so handled.

Harper at the Indiana Station and other investigators have shown conclusively that for best gains it is desirable to creep-feed lambs prior to turning them on Spring pasture. A slatted opening which permits the lambs free access to best quality hay and grain can be easily provided. It is important that the hay be of best quality, and that the grain be clean and fed in such manner that the lambs do not soil it. Clean fresh water at all times; a mineral mixture to the extent of five per cent may be added, and also be kept available for both lambs and ewes. Equal parts iodized stock salt, ground limestone and steamed bone meal make a good mineral mixture. Several sheepmen report to me that they have found the following feed mixture very desirable for creep feeding lambs: cracked corn 50 lbs., whole oats 150 lbs., wheat bran 50 lbs., soy bean or linseed meal 25 lbs.

At the Indiana market lamb show the lambs are graded before placing, and marked with colors to indicate their grade. On the day following the judging the carcasses of the lambs are made available for inspection. Under the stimulus of these good lambs Indianapolis has become one of the best lamb markets in the United States. Lambs are now exhibited also at Muncie, Fort Wayne and Evansville, Ind. The climax of the shows is the auction sale held during the afternoon. These sales have all averaged for premium highs, and due to their uniform excellence each pen of lambs has sold well. This is very desirable and commendable as it reflects a high uniform desirable quality and finish of the exhibits.

Ram Trucks

Regardless of the livestock production plan followed it will be successful in direct proportion to desirability of the breeding program being used. By using good registered rams of the breed most suitable for given conditions, farm flock owners can be assured of higher health ratios combined with greater efficiency and economy of production possibilities. Quite a few of the State Agricultural Colleges, through their animal husbandry extension service, are following the plan of covering their territories with ram trucks.

Benton's report of last season's ram truck service at the Michigan State College well illustrates the importance and value of this work. This project is sponsored and operated through the cooperation of the Michigan Pure Bred Sheep Breeders' Association which provided the rams and maintained ownership and re-

sponsibility until they were sold; the Michigan Livestock Exchange, a co-operative livestock marketing commission firm, at Detroit; and the Michigan Agricultural College. The purebred rams offered for sale were selected at a State-wide ram show held on September 23 at the College. The rams were graded by a judging committee and designated by marking as to their suitability for different kinds of flocks. Prices of the rams averaged $35, running up to $50 for tops. Undesirable rams were not accepted; 181 rams were retained and 174 were sold. By breeds they were respectively, 83 Shropshire, 55 Oxfords, 28 Hampshires, 4 Black Tops, 2 Cheviots, 1 Cotswold, and one Rambouillet.

A scrub ram, one of its lambs and the mother were carried on the truck, also another group consisting of a registered Shropshire ram, one of his lambs and its mother. The lamb from the registered ram weighed 65 pounds, carried good type and confirmation, while the one sired by the mongrel ram weighed 58 pounds, and was inferior in all respects. They were the same age and had been handled similarly. Such visual evidence was not only educational, but resulted in placing several good rams which otherwise might not have been purchased.

If sold as a feeder on Michigan markets the good lamb would have brought nine cents per pound, while the inferior lamb would have sold for seven cents. The difference in sale value of these two lambs would then have been $1.79. If computed on the basis of 50 lambs the difference would have amounted to $89.50. This represents only the initial and smallest part of the return; subsequent gains by these two types of feeder lambs would have paid for the purchase of the registered ram many times over. In addition to immediate gains the replacement value of the best ewe lambs retained for breeding purposes would not only have been reflected in heavier yields of better grading wool, but also hardier breeding ewes with greater longevity, and efficiency and economy of production.

Today's Soil Tests

Condensed from The Fertilizer Review

Dr. M. F. Morgan

Chief Agronomist, The Connecticut Experiment Station, New Haven, Conn.

SOIL testing for readily available or active chemical constitutents by simple and rapid methods (quick tests) has been on trial in some States for nearly 10 years, and has been rather generally used throughout the eastern half of the country for three of four years. With the turn of the decade into the "forties," it is timely that we should take stock of the present status of soil testing in relation to future application to soil management problems.

As one of the so-called pioneers in "quick test" methods, the writer has constantly cautioned against indiscriminate and superficial employment of the results of such techniques as a basis for fertilizer recommendations.

Following the extensive application of soil testing methods in Wisconsin, Michigan, Illinois, Indiana and Connecticut, where experiment station workers had first developed methods that gave promising results under their local conditions, numerous other States have responded to urgent demands from their farmers to be supplied with such information. The experiment stations and agricultural college extension services that have remained so skeptical of the value of soil testing that they offer no such service are now decidedly in the minority, except in sections of the country where the use of fertilizer is uncommon. Numerous fertilizer concerns, crop processing firms, and other organizations concerned with intensive crop production on an extensive scale have undertaken soil testing as a service function.

It is natural that testing for *phosphorus* has been most widely used, since this constitutent is probably more critically deficient than any other over the widest area. If a really satisfactory method for estimating the potentially available *nitrogen* could be developed, such a test would be almost equally popular. However, the nitrate and ammonia tests, while capable of giving helpful information concerning the available nitrogen in the soils at the moment, are rarely of much value in relation to the nitrogen-supplying capacity of the soil during the whole season. *Potash*

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tests rank next to phosphorus in the extensiveness of their application in soil diagnosis.

Calcium, magnesium, aluminum, and manganese tests have been most applied to the lighter, more acid and base-deficient soils of the States east and south of the corn belt. Simplifications of the more laborious laboratory procedure for measuring soil organic matter content have been frequently used to supplement or verify visual estimates based on soil color in relation to the texture. Supplemental tests, such as those for iron, zinc, copper, and boron, have been applied to a minor extent on soils of abnormal character. The iron test has frequently supplied information as to the extent to which deficient soil aeration has been in operation, and other tests occasionally gives clues as to whether or not a given constituent is present in harmful concentration, or is present in an amount sufficient to preclude possible deficiency.

The choice of methods has been largely determined by whether or not further information is sought beyond the phosphorus and potash tests. In the New England, Middle Atlantic, and Southeastern States, methods based on soil extraction with acid solutions of sodium acetate, such as the procedures developed by Morgan and Hester, are much more commonly used, since they permit the simultaneous testing for several constituents in a single soil extract.

The writer, as chairman of the soil testing committee for the American Society of Agronomy, has had occasion to give detailed study to the results of the collaborators who have examined sets of 31 "check soils" assembled from 15 States ranging from Texas to Maine and from Georgia to Wisconsin. These soils are from fields of known crop-producing ability, and in most cases the field response to the various fertilizer constituents and the needs for lime have been definitely established by the experiment stations furnishing them. A detailed report of this study will be given after a larger number of collaborators have reported. However, the 20-odd sets of results we have received have already given illuminating information as to what can be expected from soil testing.

Just a word about pH, although this is not the subject of my discussion. We have come a long way toward obtaining reliable and consistent results in this determination. Practically all tests by the newer "glass electrode" procedures check very closely. The "quinhydrone" results are in good agreement on all but two soils, where they fall down rather badly. The simpler colorimetric tests are usually within 0.4 pH of the best glass electrode results, but the variance

is much greater than for the electrometric measurements. Of more significance is the frequent lack of reliability of the pH as an *independent measurement with* reference to lime needs. Soils at from 4.7 to 5.2 pH are seriously in need of lime, whether judged from pH or from the "quick tests" that are related to soil acidity factors. These are also markedly lime-responsive in the field, except for some of the more acid-tolerant crops. The soils at from 6.0 to 8.0 pH are consistently low in aluminum, high in calcium and magnesium (in relation to texture) and non-responsive to lime. On the other hand, between 5.3 and 5.9 pH there are marked differences between lime needs at approximately the same pH, and in this group of soils the aluminum, calcium, and magnesium tests give a much better picture of how badly lime is needed than when pH alone is considered.

"Quick test" ratings in terms of such expressions as "high, medium, and low" or "good, fair, and poor" differ greatly, even when the same or similar method is used. Thus one collaborator gives the best phosphorus test in the list only a "fair" designation, while another calls it "very high." Numerical terms, such as "pounds per acre' 'or "part per million" are similarly inconsistent in order of magnitude. At first glance, the results of several collaborators on any one soil appear very divergent indeed. It is necessary to reduce the *relative* tests on the various soils to a reasonably uniform proportionate scale before a fair evaluation of the accuracy of the tests can be revealed. This can be readily done with the set of soils used in this study since with the exception of ammonia, there is a fairly good range of distribution ranging from the weakest to the strongest test. (None of the soils could be really classed as *high* in ammonia). The relative tests for the various soils by the various collaborators have been placed on a "scale of 10" (except for ammonia, on a scale of 5). This calibration has proved satisfactory in presenting the data in a workable form and has facilitated its statistical analysis. It now becomes apparent that most soils are similarly *relatively* high, intermediate, or low with respect to a particular constituent, regardless of the method or individual, provided that the work is carefully done by a trained operator using reagents that are correctly made and frequently checked as to reliability. Two or three soils are rather consistently "inconsistent" depending upon whether the extractant used is a strong solution of a slightly disassociated acid or a weak solution of a highly disassociated acid. This is especially true of the phosphorus test on highly cal-

careous soils and the potash tests on heavy clay soils.

Taken as a whole, the results of tests on this set of soils have been remarkably in harmony with the known facts concerning their character and the soil management practices that are required to obtain good crops. It might be argued that we have only proven what we know already. This is probably the case if we always have information such as is obtainable with respect to our "check soils." In most cases even the farmer, himself, has no satisfactory record of past performance, and in many cases the crop yields or fertilizer trials have been disturbed by the vagaries of weather, plant diseases, and insects.

Much needs to be done in calibrating soil test results to soils of known performance. It cannot be said too often that we can interpret soil tests to hundreds of thousands of soils in the light of careful study of tests on dozens and hundreds of soils that are of the same soil type, devoted to the same crops, as those we must diagnose. This obviously eliminates soil testing on a small scale where the only frame of reference is a series of a dozen or so tests on the few fields of a single farm.

Laboratories conducting several thousands of tests a year undoubtedly test many hundreds of soils that should not require a test to guide the proper use of fertilizers, lime, and manures. On the other hand, we are only scratching the surface in evaluating our practices through recourse to soil tests, when we consider the millions of acres of farm land of thousands of distinct soil types. Much larger funds would have to be allocated to soil testing by the State agencies, and their work would need to be integrated with greatly expanded service testing by commercial concerns if the maximum benefits of soil testing are to be attained.

Faulty interpretations of soil test results and exaggerated ideas of the significance of the tests have received numerous "kicks in the pants," and deserve a lot more than have been tendered by a tolerant and too-gullible public. Yet we feel sure that soil testing is here to stay, and that as our methods and yardsticks for interpretation improve, agriculture will lean more and more heavily on this means of putting science to work.

New Economies for the Farm Family

Mrs. Ralph Borsodi

NEARLY all rural sociologists are in agreement as to the basic proposition that the productive and creative farm family, which relies mainly upon diversified farming for its livelihood, is necessary to any real revival of country life.

Yet the possibilities of diversified farming and of farm home production with modern methods and equipment, have been studied systematically hardly at all. In spite of the fundamental importance of graphic cost comparisons of the possible returns from a *modern* diversified farm, (not a romatic old primitive type of farming), and from a *modern* one-crop farm, adequate studies have not been available. Before the studies, which the School of Living of Suffern, N. Y., is carrying on, were undertaken, there were no authoritative comparisons of the costs of home and small-scale production, with the cost of industrial production.

In 1920 Mr. and Mrs. Ralph Borsodi began their pioneer exploration of money costs and home labor in the productive country homestead.

These researches resulted in a novel approach to the problem of the farm family's adjustment to the machine age. Instead of an uncritical acceptance of the assumption that progress required that the farmer should specialize on the production of one raw material for sale to the world market, as has been taught by the advocates of farming as a business and industry, the Borsodis made an analysis in a modern frame of reference of the old independent American way of farm life. The possibilities of the scientific method in small scale production on the farm and in the home, of modern appliances and conveniences, and the use of gasoline and electricity for power, were freshly appraised in strictly economic terms.

A rapidly growing number of requests for information led to the establishment in 1934 of the School of Living, and the organization of a staff under the direction of Mr. and Mrs. Borsodi, to conduct experiments and to compile the research material which grew out of them. To make these studies available to the many inquirers, publication of a series of Homestead Bulletins was decided upon. The first completed series of ten "How to Economize" Bulletins has found a wide use in helping families begin or improve their production at home, and in the teaching in col-

lege and school classes of a program of home production.

Outstanding in this group of Bulletins is the one on the home production of flour and cereals. Grinding flour in an inexpensive motor- or electrically-driven kitchen mill is rightly a significant home activity. The Milling Bulletin dispenses with any mystery or intricacy in the making of flour. The family raises or purchases its own wheat for a few cents a pound. With very little additional cost the simple mill changes it to a complete, nutritious flour which retains the germ of the wheat, vitamin C, minerals and proteins. These vital elements are removed from commercial flour because the distance and time involved in shipping flour is sufficient to cause their spoilage or "breakdown." The School of Living Bulletin on Flour and Cereals describes the technique, illustrates the mill, and indicates the cost and savings of home production over against the commercial product.

The Baking Bulletin takes up the next step in the process. It presents formulas and methods for transferring the whole flour into "the staff of life." It completely discredits the notion retained from "grandmother's days" that bread making is a laborious all-day process. With an efficient kitchen-mixer and an automatic oven the human labor in a "batch" of bread is thirty minutes, including assembling of materials and cleaning equipment. But the equipment costs money? Yes, but when one buys "baker's bread" one is really paying for his equipment—mixers, ovens, delivery trucks, etc. It is more economical to pay for one's own equipment with the savings made on a superior home-made bread. The Baking Bulletin shows just how much is saved on various articles of home baked food.

Gardens and orchards have long been scenes of rewarding family activity in American life. But in the last decade some of our farmers have succumbed to the advertiser's insistence that it doesn't pay to raise vegetables and fruit at home. Bulletin No. 8, "How to Economize on Fruit" and Bulletin No. 9, "How to Economize on Vegetables" prove the contrary. They carefully record just what it costs in cash to raise at home the family budget of vegetables and fruit recommended by the Department of Agriculture. Many of the users of these Bulletins have been impressed by the fact that no one had ever made the comparisons (from careful records) of the costs of home grown vegetables with the cost of the same amount in the market. The savings divided by the hours spent on the garden show how much has been earned per hour of work on the garden or orchard. The results

are surprising, though one reader wrote "If my own garden vegetables cost twice as much as the ones on the market I'd still think the better food, fun and flavor I get from my own garden was well worth it." Both these Bulletins show that plants and their fruit are much superior when grown in soil which has been treated to proper rotation and natural fertilizers. This is one of the advantages of small-scale family homesteading over against the large commercial farm, which depends on inorganic fertilizers and one-crop systems.

"How to Economize on Canning" contains another significant comparison between the cost of canning at home and that of purchasing the same budget of food in the market. To those who have wanted to resist all statements "that it doesn't pay to do it at home" this Bulletin shows that a woman earns on the average of 75 cents an hour for the time she spends in canning. We've all been told how "cheap" are beans baked in cans from the grocer, but when we discover that a family's quota of baked beans will cost $4.20 in the store can be produced for $2.50 at home we have to reverse the theme song to "it doesn't pay to buy them."

The Storage Bulletin indicates the savings made when staples are stored in bulk or bought in large quantity. Definite counsel is given as to how and why to to avoid small packaged food. A comparison is made of an interesting experiment made by the Borsodi family living for a time entirely on packaged foods, and then repeating the diet for a similar time of home-prepared foods. The results are decidedly illuminating. The problem of space for bulk purchases is given thoughtful attention, and many have spoken of the help this study has been to them.

Companion studies on "How to Economize on Buying Land for Your Home" and "How to Economize on Planning Your Home" discuss two very basic ways of aiding families to establish productive homes in the country.

Hundreds of studies have been made on what it costs to maintain a herd of dairy cows, but the School of Living study on "How to Economize on Milk and Cream" is the first to reveal the earnings involved in producing milk on a family scale. In this day of high cost of milk to the consumer and low price to the producer, the production of milk for direct use by the family is a real solution. This study discloses that farm as well as city families consume milk much below a recommended diet; it discusses the choice and care of cow and goats; it contains plans for a low-cost barn; and gives the latest scientific findings on raw milk

which indicate that it is a food far superior to pasteurized milk.

A new series of ten Bulletins is now being prepared—the first of which will deal with the relative advantages of making butter, cheese and ice cream at home instead of buying these things, as more and more farmers are being told they should, not only by industry but by most agricultural and home economists.

In spite of the great trend toward commercial farming and the urban scheme of living, great numbers of farm families actually still live more or less in the old self-sufficient way and practice this "new" economy. But the novel conclusion which emerges from these studies is that the number of families which practice this scheme should be increased because the more extensively it is practiced, using modern methods and equipment, the more secure would the farm family become and the higher the standard of living which it enjoyed. Here is a new solution of the agricultural problem—without ever increasingly complicated political subsidies, without more specialization upon a few cash crops. The American farm family may enter upon a new and richer kind of living: that is evidently the lesson of these researches.

How Shall We Fertilize Vegetable Crops?

Condensed from Better Crops With Plant Food

Victor A. Tiedjens

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RESULTS from investigations to determine the best method of applying fertilizer for row crops during the past season on 17 vegetable farms indicate in each case that plowing under chemical fertilizers gave as good or better yields than the growers' methods which consisted of either row, side-dressing, broadcasting, or combinations of several methods. These tests were made on light to medium heavy soils which were fair to good for lime and pH.

The biggest yields of tomatoes on fertilizer plots at the New Jersey experimental plots at New Brunswick during the past three growing seasons were obtained where two-thirds to all of the fertilizer was broadcast before the ground was plowed. Where either 500, 1,000, or 1,500 pounds of 5-10-10 fertilizer were placed in 2-inch bands, 1 foot long and 4 inches from the plants on either side, the yields were lower by 4 tons than where the fertilizer was plowed under. Broadcasting all the fertilizer after plowing or half of it and applying the remainder as two side-dressings, or placing the superphosphate under the row and applying the nitrogen and potash as side-dressing fell short of the highest yield by 1 to 3 tons.

These results were obtained on a soil having a pH of 6.2 to 6.4. On acid soil the same plots might have produced differently. The maximum yield was 14.5 tons of tomatoes. The method that would prevent rapid fixation of the phosphoric acid undoubtedly would have produced the largest yields. The band method probably would show up much better. However this is not necessarily the case for all crops.

Sweet potatoes, which also must be grown on acid, sandy soils to prevent ground diseases from making the crop unmarketable, have not produced particularly good yields by the banding methods in comparison with other methods in experimental plots on Fred Bateman's farm at Grenloch, New Jersey. In 1939 sweet potatoes where the fertilizer was all applied as a side-dressing 2 and 5 weeks after the plants were set produced 150

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bushels more than where the fertilizer was applied in bands.

All of our vegetable crops except the two potato crops will tolerate lime and will do particularly well at a pH of 6.5 on mineral soils. At those pH values we probably need not concern ourselves with the availability of phosphoric acid.

The fact that the band method has produced the same yields with one-half the fertilizer does not seem to be any particular advantage. If the facts were known, we might just as correctly assume that the grower was using too much fertilizer and in so doing burned the roots of his plants. It seems that we have not studied enough plots to know the truth. The banding method does prevent root injury where seed is sown. Where plants are set, as with sweet potatoes, it seems that even this method of applying fertilizer retards the growth, even though the fertilizer is not in direct contact with the roots.

Our light sandy loams and loamy sands present another problem of the ease with which soluble salts leach during periods of heavy rainfall. On such soils our concern is not to prevent fixing of phosphoric acid but of supplying fertilizer in sufficiently small quantities to prevent salt injury and at intervals frequent enough to supply the needs of the plants.

The method of applying fertilizer that will produce the best results for our crops will depend on phosphoric acid availability for those crops which must be grown on acid soils, uniform distribution of fertilizer for those crops that will do best on well-limed soils, and frequent application of small quantities for those crops which are grown in sandy soil. Fertilizer injury must be prevented in each case. Furthermore, we must keep in mind the cost of the fertilizer applied to the crop in each case.

Plowing under animal manures was always considered wise practice and good assurance that a worthwhile crop would be grown. The manure was applied to the surface and plowed under with refuse, cover crops, or grass sod. It contained plant food that was released gradually as the crop grew. The area that was covered was determined by the amount available. Very often the field was only partly covered, and the crop that followed showed where the dividing line was. Generally the manure was applied for the cash or vegetable crop in a rotation, a field receiving manure only once in 3 or 4 years. Yields were not estimated on the basis of the amount of manure applied, but according to the time the crop was planted, the particular season, or on how well the ground had been prepared.

There have been many arguments regarding the method that would make the best use of ma-

nure. Who has not seen the result of hauling manure to the field and distributing it in small heaps to be spread by hand several weeks or months later? The outlines of these piles were visible several years later. It was considered poor management. But when we see the effect of row applications of chemical fertilizers several years later in the growth made from the residual fertilizer, we shrug our shoulders and say it is inevitable. I wonder whether it is? The manure spreader put an end to the manure heaps. Perhaps we need a broadcasting machine to put an end to the uneven growth from row applications of chemicals.

There was no question regarding the efficacy of manure for growing crops, and the question of toxicity or burning was never thought of. It could be used as a top-dressing on meadows and pastures by spreading it evenly over the surface, or it was plowed under for cultivated crops. Very often it was plowed under in the late summer or early fall for the crop the following spring. In spite of plowing it all under, good crops could always be expected from manure. But when we use chemical fertilizer we feel that we have to apply this plant food as close to the crop as possible when it is planted. I wonder whether this is necessary.

As far as the vegetable grower is concerned, the use of chemical fertilizer probably began with the use of superphosphate as a supplement to manure, although numerous other materials had been added to soils more or less spontaneously, in the early history of plant nutrition. Substituting chemicals for manure built up a need for research to determine the best method of applying these chemicals, and up to the present time the great bulk of these investigations has been based on the idea of applying the fertilizer on top of the plowed ground rather than deeper in the soil where the roots must function.

The use of chemicals marked the beginning of trouble for the farmer and work for the Agricultural Experiment Stations. Tests and experiments were established to compare the value of chemicals with manure. Only in recent years has the acidity of the soil been taken into consideration in such investigations. Very often the fertility level of the soil has been ignored.

Many investigations were established on soils containing too much fertility, and contradictory results were obtained. The condition of the field was not mentioned when a report of the experiment was made. Where differences were obtained, manure usually gave best results, particularly if it was supplemented with a small amount of superphosphate. Minor elements of course

played no part, because of the manure that had been used in the past. Lime was considered as a soil amendment and not a plant food. Manure contained enough calcium and magnesium to go around. Even acid soils produced good crops with manure, because toxic materials were absorbed by the manure.

Intensive vegetable production probably was responsible for the complete substitution of chemicals for manure. Manure became scarce. A few hundred pounds of chemicals substituted for manure were gradually increased by leaps and bounds. If a little was good, more was better; and finally manure was considered unnecessary, particularly since it was difficult to get. For a time chemical fertilizers gave startling results. Gradually, as the residual manure and lime were being exhausted, it required more fertilizer to get the necessary kick. And if the story were known, fertilizers were used in greater quantities, not because a complete fertilizer was needed, but because phosphorus or potassium or calcium was getting too low.

To add to the difficulty, the chemicals were used near the plants, and as the amounts increased, the roots became injured. Everything was blamed except the fertilizer. Plant pathologists, entomologists, crops specialists, and even economists were called in to diagnose the farmer's problem. All because he tried to grow plants in an unbalanced brine solution around the roots. If the plants were not injured directly, the large amount of plant food in close proximity to the roots restricted root growth, and dry weather took more than the usual toll. The tops grew abnormally, and the plants did not set fruit or were more susceptible to disease organisms.

From 1,500 to 2,000 pounds of soluble plant food per acre was and is being applied to the row under tomatoes and similar crops. Residues began to be built up which interfered with good root action. If the application of the fertilizer was followed by a heavy rain, the mortality of plants was reduced. If the plants were set in after the soil was cultivated but before a heavy rain, it was necessary to replant the crop.

About this time methods of applying fertilizers were questioned, and new methods were suggested. But in many of these methods, for some reason or other, the idea was to keep the fertilizer as close to the plant as possible without injuring the roots. Placing all the fertilizer under the row of plants resulted in a rapid growth if they escaped injury. If a season of ample rainfall prevailed, the plants grew soft and succulent, and in the case of the tomato made an extensive growth. They became crowded in the row and

failed to set fruit until late in the season. There was much more foliage than was needed to produce a good crop of fruit. Very often collar rot or other disease-producing organisms set to work in the created shady, moist environment and killed the plants before they could mature their fruit. What should have been a 20-ton yield often turned out to be less than a ton to the acre.

Cabbage grown under the same conditions made a tremendous yield, because foliage was what was needed for a marketable crop. Pritchard and Bonney Best tomatoes produced much larger yields under those conditions than did Rutgers or Marglobe. On the other hand Rutgers and Marglobe did much better during dry years when the fertilizer was not readily available to them.

Plowing under chemical fertilizers has not been adopted as a practice, and little research work has been done on it. Why shouldn't fertilizer plowed under produce as good yields as any other method of applying plant-food material? It is a method that can be used for most crops in any rotation. Furthermore, why should we apply so much quickly available plant food when we use chemicals? We never did it with manure, and we haven't gotten any better yields than we did with manure.

Row applications of any kind are conducive to poor distribution of plant food over a period of years. If the fertilizer was all used by the crop it would not matter, but we build a residue which is going to make good and poor spots in the field. Row application of fertilizer certainly does not lend itself to uniform growth in a rotation where heavy applications are made only once in 3 or 4 years. It reminds me of an alfalfa field I saw last spring in which the growth was good in regular 20-inch bands across the field interspersed with 2-foot bands on which very little alfalfa had started. Two years before, this field had been in melons for which the fertilizer had been placed under the row.

What seems to be even a greater objection to this surface application of fertilizer is the lack of penetration of phosphoric acid and lime. The phosphoric acid ties up in the soil before the surface soil is again turned under, and the lime has been neutralized and is no longer capable of correcting acidity when it is turned under. As a result our subsoils become poor media for root growth. Good crops can only be grown with healthy, vigorous roots. Now we find after years of applying fertilizer on the surface, that we have to use costly methods of subsoil conditioning to make our soils productive.

Unfortunately less than 25 per cent of the farms in New Jersey

have sufficient lime to grow good yields of vegetable crops. This probably is also true for the coastal plains States and other regions having humid climates. Phosphoric acid only becomes sufficiently mobile and thereby available to plants if there is sufficient lime in the soil to prevent aluminum and iron from coming into solution. As a result of continuous fertilization with chemical fertilizers carrying appreciable quantities of phosphoric acid and insufficient lime, there has been built up or accumulated an appreciable quantity of phosphoric acid for future use. This, however, is largely in the surface soil. The addition of lime to such a soil will gradually release this stored phosphoric acid for plant growth.

A series of plots were established on a strongly acid soil to determine the value of different amounts of phosphoric acid on the tomato. The field was limed and plots were established which received 0, 4, 8, 12 on up to 20 per cent in a 5-0-10 mixture at the rate of 1,500 pounds per acre. The second year all the plots produced approximately 16 tons of tomatoes. The third year the plot receiving 5-0-10 produced almost as many tomatoes as did the highest yielding plot which received a 5-12-10 mixture. The third year there was a slight increase in yield up to 8% phosphoric acid.

Lime was put on each year, and the pH during the 3 years was increased from 5.4 to 6.7 on a sassafras loam soil. However, the fertility of these plots changed and phosphoric acid deficiency began to show in the plants on the plots which had not received any in the fertilizer. Things like this may lead us into erroneous conclusions as to the nutrient needs of the tomato. The quick soil tests showed no appreciable amount of phosphoric acid at any time on these plots, and yet we know that a 16-ton crop of tomatoes requires considerable phosphoric acid. It is a good story on the need for lime.

Had a subsoil liming experiment been established on this ground, the value of adding lime to the subsoil would have been demonstrated. Had this field been properly limed from the start, perhaps no method of fertilization would have shown any particular advantage. However, we have seen the initiation of a new practice, fertilizing the subsoil, which is bound to give results on many farms, because we neglected that subsoil in the past by placing all our fertilizer on top of the ground and neglected to use enough lime to keep the pH at 5.5 or above. Fertilizing the subsoil of course is a temporary procedure which we can eliminate by either plowing under lime and fertilizer or keeping our

soils sufficiently well limed to make phosphoric acid more mobile in the soil.

One is tempted to ask, "What is wrong with our research program?" Why have we gone off on a tangent and evolved various makeshift methods for growing vegetable crops, particularly where we can use sufficient liming materials? There is some justification for those crops which must be grown on acid soils because of disease. There we have to use special methods to make phosphoric acid available in spite of the presence of materials which are ready and waiting to tie it up.

There seem to be a number of ideas as to the best method of applying fertilizer, and we must come to some common understanding if we are going to make progress.

First of all, most crops have a lime requirement and aluminum tolerance that determine what the condition of the soil must be regarding acidity. This is probably one reason why we have not been successful in duplicating yields from manure plots with chemicals. There are wide differences in soil types, and methods of applying fertilizers should vary with these types.

In a survey of 135 tomato farms in New Jersey in 1939 the majority applied their fertilizer under the plants or side-dressed. Only two plowed under fertilizer.

Results from experiments with liming materials very definitely show that most crops will grow better with some lime, while others actually require an abundance of liming material. If that is the case, our methods for those crops should be worked out on soils that have sufficient lime to satisfy the crop. There seems to be little justification for working out a method on acid soil for a given crop, when the real need of the crop is lime.

Investigations have revealed certain advantages for different methods of applying fertilizers, and each probably has its place in the vegetable industry.

Broadcasting fertilizer. This method consists of applying all the fertilizer on the surface after plowing and mixing it with the soil as the field is prepared for the crop. It is used for all shallow-rooted crops which are not cultivated, or for narrow-rowed crops that are cultivated with light tools. Very good results have been obtained with this method, particularly where some lime is added to the soil. The fertilizer is distributed sufficiently so that root injury does not occur. On acid soils the phosphorus will of course tie up rather quickly. However, crops grown in this manner should be grown on limed soils. The low yields would prohibit the use of acid soils. It is being used for wide-rowed crops

on dairy farms with exceptionally good results.

The main disadvantage is leaching of the nitrogen and potash on light sandy soils during a heavy rain before the crop has made sufficient root growth to meet between the rows. However, this leaching probably has been overemphasized. If the roots do not meet between the rows 3 weeks after the plants are set, the soil is probably in too poor condition to support good root action. Such plants would not be benefited by fertilizer. I saw a tomato field last summer in which the plants were just large enough to be covered by a bushel basket. The roots had not gone more than a foot from the plants, and none of the roots were very active. The plants looked badly chlorotic, were making very little growth, but had set 10 to 20 fruits. They had been given a liberal supply of fertilizer. When limestone was worked into the soil around the roots, they started to grow, and the chlorotic condition disappeared.

Broadcasting the fertilizer probably is not the best method. In the experiments where it was compared with plowing under the fertilizer at New Brunswick, it has not produced as good results. There may be certain cases where broadcasting will produce better results, but over a period of years plowing under should give better results.

Plowing under fertilizer. Plowing under the fertilizer places some in the bottom of the furrow, while some is distributed over the back of the previously turned furrow. For vigorously rooted plants this seems ideal. It is far enough from the roots to prevent injury when the plants are young, and what seems even more important, at no time does the plant obtain an excessive amount of plant food with which to make an abnormal growth. Most crops grown in rows are planted deep enough so that the fertilizer at the bottom of the furrow is actually only a few inches from the roots at the time plants are set, or if seed is planted, the young seedlings will make contact within a short time.

It distributes phosphoric acid more uniformly and places the fertilizer where more soil moisture makes it available to the plant. The subsoil does not become deficient in phosphorus or lime where fertilizer and lime are plowed under. As a result crops grow more uniformly, somewhat comparable to growth from manure.

Applying fertilizer in bands. This method has some advantages and is particularly adapted for acid soils. It has given particularly good results on potato farms, where the soils must be strongly acid to prevent scab. A potato variety that could be grown on neutral soils would be

a boon to vegetable growers who wish to grow potatoes in rotation with other vegetable crops. The same may be said of the sweet potato, but because this crop remains on the ground all season and is grown on the lighter soils, other methods of fertilization may be used.

By placing the fertilizer in 2-inch bands, 3 inches from the plant or seed and at the same level, it is possible for the roots to get ample phosphoric acid before it is fixed in the soil. Lime applied later will release this phosphoric acid. Phosphoric acid must be available more or less continuously throughout the life of the plant.

Where other crops must be grown in rotation with potatoes, the band method may be necessary to secure the most out of the soil. The method is not suitable where fertilizer is applied only 1 year in 4, because the phosphoric acid is not distributed between the rows to accommodate the crops that are grown broadcast. It may be more economical to apply the fertilizer in bands, because the grower can use less.

The split application method. Perhaps there is no better method of applying fertilizer than to apply it to the crop when it needs it, in such a manner that it can absorb it, and in such amounts that the fertilizer will not injure the roots. However, few growers will do this, regardless of how good their intentions may be. It requires several applications at timely intervals, and very often the grower does not get the application on until it is too late. There are many modifications of this method. They all mean a greater expenditure of labor for the grower, but may save him some money on fertilizer. The methods have application on the lighter and acid soils and make it possible to grow good crops on these soils but at much greater expense.

On the loamy sands or the very light sandy loam soils, 200 or 300 pounds of fertilizer may be applied under the row, and further applications would then have to be made between the rows as the crop needed it. Or the fertilizer could be used in solution, part applied when the plants are set or the seed is sown, and additional fertilizer applied in water between the rows at semi-monthly intervals. This method has given particularly good results.

There are several methods that may be mentioned: broadcasting, plowing under, or applying the phosphoric acid under the row and applying the nitrogen and potash as side-dressings at frequent intervals as needed; applying two-thirds of the fertilizer as above but applying mixed fertilizer as side-dressings; applying a third of the fertilizer under the

row and the remainder as side-dressings; or broadcasting two-thirds before or after plowing and placing the remainder under the row. These methods are applicable to acid soils, but are more costly than to correct the acidity with lime and plow under the fertilizer.

The row method. This method consists of applying all the fertilizer under the row. The fertilizer is applied on the surface and worked into the soil with a cultivator of other suitable implement. This is a good practice in years of scanty rainfall and on acid soils, but may be too much of a good thing in years of good rainfall. If the grower can use this method without killing his plants, he may get very good results. It does not give good results every year. It has few real advantages and yet is used extensively by growers, because they can get fairly good results on acid soils. Furthermore they do not spend much time putting the fertilizer on.

Starter solution. This should be mentioned, because it can be used with any method except where large quantities of fertilizer are used in the row. It consists of applying fertilizer dissolved in water around the plants as they are set, or it may be applied in the furrow with the seed. On acid soils this adjunct to other methods has given particularly good results. On well-limed soils that have received ample fertilizer in the past, there may be no advantage in using it. It has a particular use where fertilizer is plowed under.

Subsoil fertilization. Fertilization accompanies plowing of the subsoil, or lime and superphosphate are merely applied in the bottom of the furrow. This is a temporary practice that is necessary on some farms because of the too long-continued use of row, band, or surface fertilization without lime. It probably would not be necessary where fertilizer and lime have been plowed down in the past, nor where sufficient lime has been used to keep the phosphoric acid mobile. However, where it was needed, it has given phenomenal growth. Asparagus plants have made three times as much growth by this method over what was considered good growth by accepted cultural methods.

A combination of plowing under lime and fertilizer with the starter solution will probably give the best results at the least expense and will build up a permanent fertility in the soil that will eliminate the major cultural problems of the vegetable grower. Acid soils require special attention. Light sandy soils may require special attention. Where only a few pounds of fertilizer are used, row methods may be better.

Why Poults Die in the Shell

Condensed from Turkey World

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University of Kentucky

WHEN we consider hatchability, we should not consider it entirely in terms of the total number of poults that get out of the shell, but in terms of the number that are strong and healthy and ready to eat and grow. Occasionally a weak, spraddle leg poult will straighten up and come along in good condition and make a good bird for market. But this is the exception and not the rule.

One of the most important things to consider is the curve of embryo mortality. In other words, a diagram showing just when poults die in the shell. We have known for a long time that there is a peak or definite increase in embryo mortality with chicken eggs at around the third or fourth day. There may be another slight peak at the tenth to the twelfth day and a very pronounced peak of mortality around the nineteenth day, and over a period of years it has been possible to work out some methods that may prevent or minimize these peaks of mortality.

Now, if we check the time that the turkey embryo dies, we find that mortality will occur on *the fourth day and on the twenty-fifth day* with a slight amount of mortality under certain conditions during the middle of the incubation period. Suppose, now, we take this chart and superimpose it on the chart of chicken embryo mortality. We find that the peak at the first of the period and the peak toward the last part of incubation will coincide almost exactly with that of the chicken egg. The only difference is the difference in time, but when the charts are put on the same basis they look almost exactly alike. It seems to me that this point is important because it indicates that by following most of the practices that have proven successful in the hatching of chicken eggs, we should be able to get increased hatchability with our turkey eggs. Increasing the number of times that eggs are turned from two to four or more times, increased the hatchability of chicken eggs. Without running a great series of experiments, it naturally would seem wise to increase the number of times that we turn turkey eggs to at least four or more times. Turning an uneven number (at

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least five times) means that the eggs are on a different side each night. Therefore, there is not so much chance of the embryos sticking to the shell.

Turning eggs tends to decrease the mortality during the first period. In other words, around the third or fourth days when eggs are only turned twice the mortality will be much greater. There are a great many more of the embryos likely to stick to the shell at this time. Consequently, we have the first thing to be done to prevent mortality, that is, turn more often.

While we are considering the first period of incubation we must remember that there may be a weakness in the breeding stock which will cause weak embryos. While this is partially theoretical, it is wise to watch your turkey pens to be certain that they are not giving you a large number of weak germs. When eggs that are clear at this time are broken out there will often times be a large number of very small embryos which died early in the incubation period. This may indicate either a weakness of the germ or it may indicate poor facilities for holding the eggs. It is a good practice to have the eggs cooled quickly after they are gathered, then placed in turkey egg cases, in fillers the correct size, small end down and have them kept in a room that is between 50 and 60 degrees F. The case should be slanted from one end to the other at least twice daily by setting a brick under first one end and then the other.

If two or three hens lay in the same nest, it is very easy to see that the temperature of the egg will be kept high enough for the embryo to start to develop all through the day that the eggs are laid and there may be enough development so that the cooling of the eggs will kill a great many of the embryos so treated. If this occurs, it is not fair to blame incubation conditions. Gather the eggs often. Proper care of the eggs will increase hatchability, particularly in the early summer months after the weather has become warm.

The next important period in incubation, as far as mortality is concerned, is around the twenty-fifth day, and there are several things that can be done to decrease the number of poults that die at this time. Among the most important factors causing death at this time are poor incubation facilities and lack of proper feed for the breeders. Since this period of high mortality seems to be so intimately connected with incubation, we oftentimes lose sight of the fact that there can be a definite mortality due to poor feeding practices. For example, if the breeding stock does not have enough vitamin D or sufficient calcium carbonate in the form of limestone or oyster shell, or if

manganese is low, then we can have a rather high mortality at this time, a mortality that is rather difficult to trace unless we actually are carrying on experiments with these feeds. For example, we know that chicken hens which are kept on a diet low in manganese will produce eggs having rather thin shells and these eggs in turn will fail to hatch or will hatch only from five to ten percent. When those eggs are broken out, we find that the embryos have very short legs, parrot beaks and usually a swelling on the back of the head that has some watery material in it. The addition of four ounces of manganese sulphate to the ton of feed completely prevents this condition and the hatchability becomes normal again.

Now if we run the same type of experiment with turkey hens, we likewise find a high mortality in the last period of incubation, and we can prevent this by the addition of manganese sulphate or other comparable manganese compounds. On the other hand, it seems that the turkey does not need quite as much manganese, and we do not have the deformed embryos that we get with chickens. However, for the purpose of safety, we suggest the same four ounces of manganese sulphate to the ton of mash.

In sections of the country where there is plenty of sunshine and where fish liver oil is fed in the mash, there should not be a great deal of trouble with a lack of vitamin D. However, this is very important and should not be neglected, if you expect to get good results. If breeding stock does not get sufficient vitamin D, the poults will get almost to the time of hatching and will die. We know in chickens that actually the embryo has less calcium and phosphorus or bone forming material in the body when the hens do not have enough vitamin D in the ration.

While there are other feeding factors, including the necessity for a good supply of oyster shell or limestone, the incubation factors should be considered also. One of the first factors it seems to me is that of humidity, and I would like to throw in a word of caution by quoting from the article in *Turkey World*, in which Dr. Asmundson, University of California, is quoted as saying that "many recommendations made for hatching turkey eggs in the East call for too high humidity (for the West) while the eggs are hatching." This serves to indicate that conditions vary throughout the country, and anything that I may say in regard to control of humidity may not apply directly to your section.

However, one or two suggestions may be valuable especially to those in the Middle-west and South. Experience has taught us

here that there should be a positive control of humidity at hatching time. The eggs should be placed in the hatching trays after candling on the twenty-fourth day of incubation, or one day before we expect the final peak of mortality and at that time the moisture should be raised. I should mention here that under our conditions we have gotten the best hatches when the wet bulb has been run at 85 to 88 degrees F. during the first 23 days and at 90 degrees F. thereafter with a dry bulb temperature of 99 to 100 degrees F. We suggest that the moisture should be raised to 90 degrees F. on the twenty-fourth day of incubation and kept at that point until the hatch is fully completed. There seems to be a good reason for this. We have found that when the moisture is not raised it will come up to this figure shortly after the hatching starts, but that oftentimes we get a number of crippled or weak poults that do not quite make it out of the shell; whereas if the moisture is high before that age we rarely ever have a large number of weak poults at this time. We have no quarrel with the person who would rather run his moisture during the first 23 days at a lower figure. The differences in hatchability when the moisture is slightly lower and when they are run at 85 to 88 are so slight that they are not very significant when a statistical analysis is made. It seems to us in this connection that it is better to follow the incubator manufacturer's directions until you find that climatic conditions make a slight change necessary. Let me emphasize at this time that I am speaking of a slight change. Do not make too drastic changes in either your temperature, moisture or ventilation and if you are really desirous of finding out the trouble do not make more than one change at a time.

I would like to suggest the keeping of the set of records for your incubator. Some of the larger machines have automatic recorders for temperature and sometimes for moisture. These should be studied carefully, and if you do not have this method of recording your temperature and moisture, keep a record indicating the temperature and moisture at the time you turn the eggs and also a notation of anything that is abnormal. For example, did the water pressure go down during your hatch; was the current off; did the room become unreasonably warm or cold? All of these things will help you check back to find out what your trouble was and will help make it possible for you to get a much better hatch in the future.

Timely Suggestions for Windrow Harvesting

Condensed from The Dakota Farmer

George Innes

AS the combine comes into the areas of the northwestern states, the method of harvesting with the combine is becoming more and more that of windrowing and permitting the windrow to remain on the ground several days to reduce the moisture content of the grain so that it can be picked up and threshed.

Within the last few years small combines have come into use. They vary in sizes from those that have cutter bars 40 inches long to those that have cutter bars six feet in length. The older, large, 12 and 16-ft. windrowers have altogether too great a capacity for these small combines.

The grain binder has been used largely for preparing the windrows for the little combines. The grain binders are from 8 to 10 foot cut and obviously they are not always properly adaptable for the combines of smaller capacity. The binder can be made to be a good windrower at small cost.

There has been a great deal of discussion as to how best to make a windrow. The writer, having had experience throughout quite a number of years, would propose as follows:

When a binder is used for a windrower, by all means do not discharge the windrow off the platform canvas. This is a method to be absolutely avoided. The grain and straw should be carried up as if it were to be bound. The binding mechanism is removed and the straw is discharged into the windrow from the deck of the binder. However, there are several things that must also be kept in mind—(1) straw should never be dropped. It should be laid down. If the straw is dropped even so short a distance, certain of the heads will go down between the stubble and lie on the ground. But if a device is used for paying the straw out on top of the stubble, an air space is provided between the windrow and the ground. (2) The stubble should not be longer than eight inches and it is better if it is six or seven inches. If the stubble is longer than eight inches and the windrow has any considerable weight, it will gradually settle to the ground and no air space is left. If the stubble is six inches long it will be almost certain that there will be an air space left open even though there should be succession of rains after the win-

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drow has been laid and before it is threshed. Another thing that is most desirable, with reference to windrowing, is to be able to keep the grains from sprouting. They will not sprout if they do not touch the ground. If an air space is left underneath, they will dry out quickly after rains and permit threshing. (3) The straw should be laid nearly parallel to the direction of travel. There has been an inclination to lay the straws of the windrow in a diagonal position at greater angle; the argument for that being that the windrow is wider and it is held from the ground by putting it on a greater width of stubble tops. But there are several things that defeat that purpose. If the straws are laid at an angle even of not more than 25 degrees from the line of forward travel, all the heads are on one side of the windrow and all the butts of the straw are on the other side. Thus, there is no mattress of straw beneath the heads. The side with the heads on is heavier than the side with butts so almost immediately that weight of the heads causes the straw to incline downward toward the head and give a pitch to the windrow toward the heads. Then as rains come, it sheds from the butts toward the heads, thus increasing the weight of the heads excessively and softening correspondingly the smaller stems of straw which are near the heads, allowing it to bend over, and the heads assume a perpendicular position and touch the ground. Then, of course, sprouting occurs.

If all the straws are laid nearly parallel to the direction of travel, the heads lie on top of the windrow and lie upon the mattress of straw that has preceded it. Therefore, even if the stubble be longer than eight inches and the entire windrow should sink to the ground, at least the heads cannot come in direct contact with the ground but will have a thickness of straw beneath them to prevent sprouting. Furthermore, when the windrow that is laid nearly parallel is picked up with a modern type pick-up, the straws can be separated and spread onto the canvas and fed into the cylinder much more fully throughout the length of the cylinder and much more evenly than if the heads were far to one side. It is apparent that if all the windrow goes up the canvas in the width as it was made and goes into the cylinder at one small portion of its length, it is not going to be threshed as well as it would if the heads were spread throughout the length of the cylinder. Not only that, but when the grain comes to the rack and shoe it will not be evenly distributed.

How to accomplish this proper laying of a windrow with a binder? The packers, needle and total binding mechanism should be re-

moved from the binder. A sheet of metal should be placed on the deck through which the packers and needle operated to close up the slots and prevent any wastage of grain through the slots. The sheet should be long enough so that at its lower end a trough can be formed out of it. Bring the sheet up high enough on its other side so that no grain will be lost over the side. The bottom of the trough should be about eight inches wide at its forward end and about 12 inches wide at the back so that the straw will slide out easily. At its forward end the trough should be about 12 inches from the ground. At the back it should be about seven inches from the ground. It would be well to make it so that it could be raised or lowered and adjusted to the length of the stubble, but if the back end of the trough is about one inch nearer the ground than the top of the stubble, then if the stubble is bent over and flexed forward beneath the trough, it will not be broken and will straighten up after the trough has passed, and will assist the grain in flowing from the trough onto the top of the stubble gently enough so that it is held there to cure.

To use an illustration of what is meant, if one would take some cut straws on a pitch fork and drop them to the ground, a large part of them would slip through the stubble and go to the ground. If, on the other hand, a fork full of cut straws were taken and held at the top of the stubble and the pitch fork pulled out from beneath allowing it to rest on the stubble, it would stay there.

It is much more economical to windrow for harvesting with the small combine in the "Short Straw country" than to direct combine because in a large percentage of cases an 8-foot windrow can be threshed by a No. 1 combine at the same speed that it would be drawn to cut and thresh a 4½-foot swath.

For the Farmer's Library

These books are recommended as outstanding in their field:

Beef Cattle—By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Son, Inc. $4.00.
(See Farmers Digest, November, 1939)

Breeding Your Own, or Raising Colts for Pleasure and Profit — By Clarence E. Bosworth. The Derrydale Press ($10.00). A book suitable for the breeders of hunters' and saddle horses.

Dairy Cattle and Milk Production—By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. Macmillan Company. $3.60.
(See Farmers Digest, February, 1940)

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, head of the Animal Dept., Cornell Univ. Morrison Press. $5.00.
(See Farmers Digest, October, 1939)

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. Macmillan Co. $2.90.
(See Farmers Digest, January, 1940)

Livestock and Poultry Diseases—By W. A. Billings, Asst. Prof. of Vet. Medicine, Univ. of Minnesota. Macmillan Co. $3.50.
(See Farmers Digest, June, 1940)

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw, Hill & Co. $4.00.
(See Farmers Digest, July, 1939)

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. Macmillan Co. $3.75.
(See Farmers Digest, September, 1939)

Vegetable Crops—By Homer C. Thompson, Ph.D., Prof. Veg. Crops, Cornell Univ. Pub. McGraw Hill Book Co. $5.00.
(See Farmers Digest, May, 1940)

For the convenience of our readers, books listed may be purchased through this Department. Address C. Leavitt Dyer, Farmers Digest, Ambler, Pa.

Soil Conservation Bulletins

To Hold This Soil
Miscellaneous Publication No. 321, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 45c

Terracing for Soil and Water Conservation
Farmers' Bulletin No. 1789, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 10c

What is Soil Erosion?
Miscellaneous Publication No. 286, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 15c

Strip Cropping for Soil Conservation
Farmers' Bulletin No. 1776, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 5c

The Land in Flood Control
Miscellaneous Publication No. 331, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 10c

Conservation Farming Practices and Flood Control
Miscellaneous Publication No. 253, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 5c

Soil-depleting, Soil-conserving and Soil-building Crops
Leaflet No. 165, Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 5c

Soil Conservation Districts for Erosion Control
Miscellaneous Publication No. 293, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 10c

Soil Defense in the Northeast
Farmers' Bulletin No. 1810, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 15c

Erosion on Roads and Adjacent Lands
Leaflet No. 164, U. S. Department of Agriculture
For sale by the Supt. of Documents, Washington, D. C. Price 5c

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